HumaStar 300

| Service Manual

CE

Cat No. 17901s/2

Human

Diagnostics Worldwide

REVISION LIST OF THE MANUAL

Rev. /DATE.	REVISION DESCRIPTION

SYSTEM VERSION

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SERVICE UND SUPPORT

TABLE OF CONTENTS

1 SAFETY INSTRUCTIONS 1

1.1 INTRODUCTION 1
1.2 USER WARRANTY 1
1.3 INTENDED USE OF THE INSTRUMENT 2
1.4 GENERAL SAFETY WARNINGS 2
1.5 DISPOSAL MANAGEMENT CONCEPT 3
1.6 INSTRUMENT DISINFECTION 3
1.7 BIOHAZARD WARNING 4

2 THE ANALYZER - HUMASTAR 300 7

2.1 GENERAL DESCRIPTION 7
2.2 MAIN CHARACTERISTICS 7
2.3 OPERATION 10
2.4 USER WARRANTY 11
2.5 INSTALLATION 12
2.5.1 Unpacking 12
2.5.2 Installation 13
2.5.3 Environmental Requirements 13
2.5.4 Livel setting of Analyzer 13
2.5.5 Operating-Temperature-Limits 13
2.5.6 Power Requirements 14
2.6 ASSEMBLY PROCEDURE 14
2.6.1 External Connections 14
2.6.2 Connections in the back of the Analyzer 15
2.6.3 Hydraulic Connections 16
2.7 ANALYZER COMPONENTS 17
2.7.1 Monitor 17
2.7.2 TOP View of the analyzer 17
2.7.3 Analytical Plate 17
2.7.4 Reagent Chamber 18
2.7.5 Reagent Arm 19
2.7.6 Sample Tray 19
2.7.7 Sampling Arm 21
2.7.8 Probe Washing Well 22
2.7.9 Sample and Reagent Diluter 22
2.7.10 Peristaltic Washing Pumps 24
2.7.11 Photometer Module 24

2.8 SOFTWARE 24

3 OVERALL BLOCK DIAGRAMM (P/N: EI0110.01) 27

3.1 POWER SUPPLY CONNECTIONS (P/N:EI0107.01) 27
3.2 MAIN POWER SUPPLY ASSEMBLY (P/N: AY0097.04) 29
3.2.1 PCB Power Distribution (P/N: 17970/27) 29
3.2.2 Transformer (P/N: EM0050.01) 30
3.2.3 PC Power Supply (P/N: 17956/1) 30
3.2.4 Power Supply + 24V (P/N: 17956/2) 31
3.3 POWER SUPPLY BOARD (P/N: 17970/7) 31
3.4 POWER SUPPLY MAINTENANCE 33
3.4.1 To remove the Power supply 33
3.4.2 Replacement of the PC Power Supply 35
3.4.3 Main Power Switch Replacement 35
3.4.4 Fuse Replacement 36
3.4.5 To replace Transformer 36
3.4.6 Replace Power Supply + 24V 37
3.4.7 Replacement of the Power Distribution Board 37
3.5 TROUBLE SHOOTING GUIDE 37
3.6 SPARE PARTS 41
3.7 ENCLOSED DOCUMENTATION 43
3.7.1 EI0110.01.0.DW (block diagram) 43
3.7.2 EI0107.01.0.DW (block diagram) 43
3.7.3 EI0107.01.0.SC (electrical diagram) 43
3.7.4 17970/27.B.SC (electrical diagram) 43
3.7.5 17970/27.A.PM (assembly drawing) 43
3.7.6 EM0050.01.B.SC (electrical diagram) 43
3.7.7 EA0067.02.0.SC (electrical diagram) 43
3.7.8 17970/7.A.SC (electrical diagram) 43
3.7.9 17970/7.B.PM (assembly drawing) 43

4 INTERFACE PUMP - VALVES (P/N: 17970/24) 55

4.1 MAINTENANCE 57
4.1.1 To Replace Pump Interface and valves 57
4.2 TROUBLE SHOOTING GUIDE 58
4.3 SPARE PART LIST 60
4.4 ENCLOSED DOCUMENTATION 60
4.4.1 17970/24.A.SC (electric diagram pag. 1/3) 60
4.4.2 17970/24.A.SC (electric diagram pag. 2/3) 60
4.4.3 17970/24.A.SC (electric diagram pag. 3/3) 60

4.4.4 17970/24.A.PM (assembly drawing) 60

5 POWER SUPPLY PHOTOMETER LAMP (P/N: 17970/10) 67

5.1 TROUBLE SHOOTING GUIDE 68

5.2 SPARE PART LIST 68

5.3 ENCLOSED DOCUMENTATION 69

5.3.1 17970/10.A.SC (electrical diagram) 69

5.3.2 17970/10.A.PM (assembly drawing) 69

6 MICROPROCESSOR ASSEMBLY (P/N: EA0073.02) 73

6.1 CPU SLAVE (P/N:17970/8) 74

6.2 MOTHER BOARD (P/N: 17970/9) 82

6.3 MAINTENANCE 85

6.3.1 CPU slave board replacement 85

6.3.2 Mother Board replacement 85

6.4 TROUBLE SHOOTING GUIDE 86

6.5 SPARE PART LIST 89

6.6 ENCLOSED DOCUMENTATION 90

6.6.1 EB0045.00.B.SC (electrical diagram) 90

6.6.2 17970/8.A.PM (assembly drawing) 90

6.6.3 17970/9.A.SC (electrical diagram) 90

6.6.4 17970/9.B.PM (assembly drawing) 90

7 DILUTER DRIVER (P/N: 17970/11) 97

7.1 MAINTENANCE 99

7.1.1 Replacement of Driver Board 99

7.2 TROUBLE SHOOTING GUIDE 100

7.3 SPARE PART LIST 101

7.4 ENCLOSED DOCUMENTATION 101

7.4.1 17970/11.A.SC (electrical diagram) 101

7.4.2 17970/11.C.PM (assembly drawing) 101

8 MOTOR CONTROL ASSEMBLY (P/N:AY0113.01, AY0114.01) 105

8.1 M/B MOTOR CONTROL MOTOR (P/N: 17970/26) 105

8.2 M/B MOTOR CONTROL (P/N: 17970/26) 107

8.3 DRIVER FOR STEPPER MOTOR (P/N:17970/20 - 23) 109

8.4 MAINTENANCE CONTROL MOTOR ASSEMBLY 111

8.4.1 Driver module replacement 111

8.4.2 Replacement of M/B Contorl motor board 111

8.5 TROUBLE SHOOTING GUIDE 112
8.6 SPARE PART LIST 114
8.7 ENCLOSED DOCUMENTATION 115
8.7.1 17970/26.A.SC (electrical diagram) 115
8.7.2 17970/26.A.PM (assembly drawing) 115
8.7.3 17970/26.A.SC (electical diagram) 115
8.7.4 17970/26.A.PM (assembly drawing) 115
8.7.5 EB0092.01.A.SC (electrical diagram) 115
8.7.6 EB0092.02.A.PM (assembly drawing) 115
8.7.7 EB0092.03.A.PM (assembly drawing) 115
8.7.8 EB0092.04.A.PM (assembly drawing) 115
8.7.9 EB0092.05.A.PM (assembly drawing) 115
8.7.10 EB0092.06.A.PM (assembly drawing) 115

9 DATA PROCESSING OF THE OPTICAL SIGNAL 127
9.1 PREAMPLIFIER (P/N: 18720/8) 127
9.2 CONVERTER A/D (P/N: 17970/19) 128
9.3 PHOTOMETER (P/N:17970/30) 130
9.4 MAINTENANCE 131
9.4.1 Photometer Module 131
9.4.2 Replacement of the preamplifier 131
9.5 TROUBLE SHOOTING GUIDE 132
9.6 SPARE PART LIST 135
9.7 ENCLOSED DOCUMENTATION 135
9.7.1 18720/8.A.SC (electrical diagram) 135
9.7.2 18720/8.A.PM (assembly drawing) 135
9.7.3 17970/19.A.SC (electrical diagram) 135
9.7.4 17970/19.B.PM (assembly drawing) 135

10 PERSISTALTIC PUMP DRIVER (P/N: EB0033.XX) 141
10.1 LINEAR PUMP DRIVER (P/N:EB0122.01) 143
10.2 MAINTENANCE 144
10.2.1 Replacement Peristaltic Pump Driver Board 144
10.2.2 Replacement of the linear pump driver board P6 145
10.3 TROUBLE SHOOTING GUIDE 145
10.4 SPARE PART LIST 147
10.5 ECLOSED DOCUMENTATION 147
10.5.1 8EB0033.01.A.SC (electrical diagram) 147
10.5.2 EB0033.01.A.PM (assembly drawing) 147

10.5.3 EB0033.02.A.SC (electrical diagram) 147
10.5.4 EB0033.03.A.SC (electrical diagram) 147
10.5.5 EB0033.03.0.PM (assembly drawing) 147
10.5.6 EB0122.01.0.SC (electrical diagram) 147
10.5.7 8EB0122.01.0.PM (electrical drawing) 147

11 ENCODER MOTORE 157
11.1 ENCODER MOTOR + HOME (P/N EB0120.01) 159
11.2 MAINTENANCE 162
11.2.1 Replacement of the Encoder board 162
11.3 TROUBLE SHOOTING GUIDE 163
11.4 SPARE PART LIST 164
11.5 ENCLOSED DOCUMENTATION 165
11.5.1 EB0072.01.A.SC (electrical diagram) 165
11.5.2 EB0072.01.A.PM (assembly drawing) 165
11.5.3 EB0120.00.0.SC (electrical diagram) 165
11.5.4 EB0120.01.0.PM (assembly drawing) 165

12 LIQUID LEVEL SENSOR (P/N:17970/31) 171
12.1 MAINTENANCE 172
12.1.1 Replacement of Level Sensor and its flat cable 172
12.2 TROUBLE SHOOTING GUIDE 173
12.3 SPARE PART LIST 174
12.4 ENCLOSED DOCUMENTATION 174
12.4.1 17970/31.0.SC (electical diagram) 174
12.4.2 17970/31.0.PM (assembly drawings) 174

13 OPTICAL SENSOR (P/N: EB0086.XX, PN: EA0071.01, P/N: EA0075.01) 179
13.1 MAINTENANCE 179
13.2 TROUBLE SHOOTING GUIDE 180
13.3 SPARE PART LIST 180
13.4 ENCLOSED DOCUMENTATION 181
13.4.1 EB0086.00.0.SC (electrical diagram) 181
13.4.2 EA0071-75.00.0.SC (electrical diagram) 181

14 COMPUTER MODULE (P/N: AY0096.01, P/N: AY0199.01) 185
14.1 COMPUTER PC MASTER (P/N: 17889) 186
14.2 PASSIVE BOARD 6 SLOT ISA BUS (P/N: 17810/7) 187
14.3 MULTI - SERIAL PORT (P/N: 910.002.031) 188
14.3.1 Check and the configuration multi-serial board parameters **188**
14.4 CONFIGURATION OF BIOS 190
14.5 TO INSTALL SOFTWARE FROM CD-ROM TO HARD DESK 193
14.5.1 To Save the SW Archives **194**
14.5.2 Preparation HW **194**
14.5.3 Update SW **194**
14.5.4 To Restore HW **195**
14.5.5 To Restore SW **195**
14.6 MAINTENANCE 195
14.6.1 To Replace the PC MAster Board **195**
14.6.2 To Replace the multi-serial Board **196**
14.6.3 To Replace the Hard Disk and the Floppy Driver **196**
14.6.4 To Replace the passive ISA BUS Board **196**
14.7 TROUBLE SHOOTING GUIDE 196
14.8 SPARE PART LIST 199

15 MISCELLANEOUS 201
15.1 DILUTER (P/N: AY0069.05) 201
15.2 AIR PUMP (P/N: AY0121.02) 202
15.3 COOLING SYSTEM (P/N: AY0115.01) 202
15.4 THERMOSTAT (P/N: AY0131.01) 203
15.5 MAINTENANCE 203
15.5.1 Diluter **203**
15.5.2 Thermostat **206**
15.5.3 Cooling System **208**
15.6 TROUBLE SHOOTING GUIDE 212
15.7 SPARE PART LIST 213
15.8 ENCLOSED DOCUMENTATION 214
15.8.1 AY0121.00.0.SC (electrical diagram) **214**
15.8.2 M0145.01.0.SC (electrical diagram) **214**
15.8.3 AY0115.01.0.SC (electrical diagram) **214**
15.8.4 EA0098.01.0.SC (electrical diagram) **214**

16 HYDRAULIC SYSTEM (P/N: HY0012.01) 221
16.1 HYDRAULICS OF THE SAMPLING SYSTEM 221
16.2 HYDRAULICS OF THE INCUBATION BATH 221
16.3 HYDRAULICS OF WASHING AND DRYING THE CUVETTES 222
16.4 WASTE HYDRAULICS 222
16.5 MAINTENANCE 222
16.5.1 General RuLes 222
16.5.2 Peristaltic Pumps 223
16.6 TROUBLE SHOOTING GUIDE 226
16.7 SPARE PART LIST 228
16.8 ENCLOSED DOCUMENTATION 229
16.8.1 HY0012.01.F.CM (Hydraulic diagram page 1 out of 4) 229
16.8.2 HY0012.01.F.CM (Hydraulic diagram page 4 out of 4) 229
16.8.3 HY0012.01.F.CM (Spare part list page 2 out of 4) 229
16.8.4 HY0012.01.F.CM (Spare part list page 3 out of 4) 229

17 TEST PROGRAM 235
17.1 DESCRIPTION 235
17.2 DIAGNOSTIC UTILITY 236
17.3 TO RUN DIAGNOSTICS USING THE TESTER.EXE 237
17.3.1 Important Notes and Precautions 237
17.3.2 Utility Reagent System 238
17.3.3 Utility Reaction cuvette - Measuring System 244
17.3.4 Utility of the Sampling System 249
17.4 PRINTMETH.EXE 253
17.5 SATSMITH.EXE 256
17.6 SAVEDBCHEM.EXE 257
17.7 COMMUNICATION PROTOCOL 258
17.7.1 Data Exchange with Host computer 258
17.7.2 Host computer Setup 259
17.7.3 Connections 259
17.7.4 Protocol Structure 259
17.7.5 Transfer of a WorkList (Reception from Host) 260
17.7.6 Transferring Results to Host computer 262

18 MAINTENANCE 267
18.1 PREFACE 267
18.2 OPERATING PROGRAM CHECKS 267
18.2.1 Reagent System 268
18.2.2 Sampling System 269

18.2.3 Reaction and Measurement System Checks 270
18.3 DEVICED FOR MAINTENANCE 272
18.3.1 To remove casing 273
18.4 PHOTOMETER MODULE 275
18.4.1 Photometer 275
18.4.2 To Equalize and Replace Filters 277
18.4.3 Replace Motor and Belt. 280
18.4.4 Replace and clean lenses 281
18.5 TEMPERATURE ADJUSTMENT AND CONTROL 281
18.5.1 Check Temperature in Incubation Bath 281
18.5.2 Check Temperature in the Reagent Chamber 283
18.6 PREPARATION SYSTEM 283
18.6.1 Sampling Arm, vertical movement (Probe) 284
18.6.2 Sampling Arm, rotational movement 286
18.6.3 Reagent Chamber 290
18.6.4 Sample Plate 293
18.7 MEASUREMENT SYSTEM 296
18.7.1 Check Reaction and Measurement Plate 297
18.7.2 Cuvette Washing Arm 303
18.8 PROGRAMMED MAINTENANCE 308
18.8.1 Daily Check 308
18.8.2 Every two weeks 309
18.8.3 Once a month or when necessary 309
18.8.4 Every six months or when necessary 310
18.8.5 Replace Photometer Lamp 310
18.8.6 Programmed Maintenance Table 310

19 GENERAL TROUBLE SHOOTING GUIDE 313
19.1 PROBLEMS WITH POWER SUPPLY 313
19.2 PROBLEMS WITH MASTER COMPUTER AND ITS CPU SLAVES 313
19.3 PROBLEMS WITH DILUTER 314
19.4 MECHANICAL MOVEMENT PROBLEMS 314
19.5 TEMPERATURE PROBLEMS 315
19.6 PROBLEMS WITH PHOTOMETER, PRE-AMPLIFIER AND LAMP 315
19.7 PROBLEMS WITH UNRELIABLE RESULTS 316
19.8 PREPARATION PROBLEMS 318
19.9 PROBLEMS WITH LEVEL SENSORS AND MIXER 319
19.10 PROBLEMS COOLING SYSTEM 321
19.11 PROBLEMS WITH THERMOSTAT 321
19.12 PROBLEMS WITH PUMPS AND VALVES 322
19.13 LEAKAGE PROBLEMS 322
19.14 PROBLEMS WITH PRINTER 323
19.15 WARNING SIGNALS, ALARMS AND FLAGS 324

20 ACCESSORIES AND SPARE PARTS 327
20.1 ACCESSORIES AND GENERAL SPARE PARTS 327
20.2 ELECTRONIC BOARDS 328
20.3 CABLE KIT MASTER COMPUTER (P/N: KG0058.01) 329
20.4 FUSES 329
20.5 PROGRAMMABLE DEVICES 329
20.6 GENERAL SPARE PARTS 330
20.7 INTERFERENCE FILTERS AND OPTICAL PARTS 330
20.8 COMPLETE MODULES 331
20.9 CONNECTORS AND HYDRAULIC ACCESSORIES 331
20.10 FLAT CABLES IN MOVEMENT 332
20.11 FLAT CABLES FIXED 332
20.12 CALBES UNIPOLAR 332
20.13 MOTORS 333
20.14 ENCORDER ASSEMBLIES 334
20.15 BELTS 334
20.16 SERVICE KIT (P/N:KG0065.01) 334
20.17 BAR CODE READER ASSEMBLY (P/N:AY0133.01) 335
20.18 KIT BAR CODE READER SAMPLES (P/N: KG0055.02) 335
20.19 KIT BAR CODE READER REAGENTS (P/N: KG0055.03) 336
20.20 KIT BAR C. READER REAG-SAMPLE (P/N: KG0056.01) 336
20.21 ISE MODULE (P/N: KG0019.01) 336
20.22 DEVICES FOR MAINTENANCE (P/N: KG0070.01) 337

21 OPTIONAL MODULES 339
21.1 BAR CODE READER 339
21.1.1 Bar Code Reader Interface (P/N: EB0111.01) 340
21.1.2 Assembly Procedure and Maintenance 340
21.1.3 Bar Code Reader Optical Alignment 342
21.1.4 Trouble Shooting Guide 347
21.1.5 Spare Part List 348
21.2 DOCUMENTATION 349
21.3 ISE MODULE (P/N: KG0019.04) 352
21.3.1 Introduction 352
21.3.2 Some Highlights and Specifications 353
21.3.3 ISE Control Board (P/N: EB0181.02) 354
21.3.4 pERISTALTIC PUMP DRIVE (p7n. eb0161:05-06) 357
21.3.5 Serial adapter Board (P/N: EB0171.01) 359
21.3.6 Power Supply for the ISE Module 359
21.3.7 REagents and Solutions needed 359
21.3.8 The ISE Module Parts 360
21.3.9 Mounting and Connecting 361
21.3.10 Operative Procedure 365
21.3.11 Urine determination 366
21.3.12 Maintenance 366
21.3.13 Trouble Shooting Guide 371
21.3.14 Spare Part List 373
21.4 DOCUMENTATION 376

CONTENTS

CONTENTS

1 SAFETY INSTRUCTIONS

1.1 Introduction

This manual is considered as a part of the instrument; it has to be at the operator's hand as well as at the maintenance operator's availability. For accurate installation, use and maintenance, please read the following instructions carefully. In order to avoid instrument damage or personal injury, carefully read the "GENERAL SAFETY WARNINGS", describing the suitable operating procedures. In case of breakdowns or any troubles with the instrument, apply to the local Technical Service.

1.2 User Warranty

HUMAN warrants that instruments sold by one of its authorised representatives shall be free of any defect in material or workmanship, provided that this warranty shall apply only to defects which become apparent within one year from the date of delivery of the new instrument to the purchaser.
The HUMAN representative shall replace or repair any defective item at no charge, except for transportation expenses to the point of repair.
This warranty excludes the HUMAN representative from liability to replace any item considered as expendable in the course of normal usage, e.g.: lamps, valves, syringes, glassware, fuses, diskettes, tubing etc.
The HUMAN representative shall be relieved of any liability under this warranty if the product is not used in accordance with the manufacturer's instructions, altered in any way not specified by HUMAN, not regularly maintained, used with equipment not approved by HUMAN or used for purposes for which it was not designed.
HUMAN shall be relieved of any obligation under this warranty, unless a completed installation / warranty registration form is received by HUMAN within 15 days of installation of this product.
This warranty does not apply to damages incurred in shipment of goods. Any damage so incurred shall be reported to the freight carrier for settlement or claim.

1.3 Intended Use of the Instrument

IVD

The instrument is intended for in vitro diagnostic application by professional users. It has to be used for the expected purposes and in perfect technical conditions, by qualified personnel, in working conditions and maintenance operations as described in this manual, according to the GENERAL SAFETY WARNINGS. This manual contains instructions for professional qualified operators.

1.4 General Safety Warnings

Use only chemical reagents and accessories specified and supplied by HUMAN and/or mentioned in this manual. Place the product so that it has proper ventilation.

The instrument should be installed on a stationary flat working surface, free from vibrations.

Do not operate in area with excessive dust.

Work at room temperature and humidity, according to the specifications listed in this manual.

Do not operate this instrument with covers and panels removed.

Only use the power cord specified for this product, with the grounding conductor of the power cord connected to earth ground.

Use only the fuse type and rating specified by the manufacturer for this instrument, use of fuses with improper ratings may pose electrical and fire hazards.

To avoid fire or shock hazard, observe all ratings and markings on the instrument.

Do not power the instrument in potentially explosive environment or at risk of fire.

Prior to cleaning and/or maintaining the instrument, switch off the instrument and remove the power cord.

For cleaning use only materials specified in this manual, otherwise parts may become damaged. It is recommended always to wear protective apparel and eye protection while using this instrument. Respective warning symbols, if appearing in this manual, should be carefully considered.

1.5 Disposal Management Concept

The currently valid local regulations governing disposal must be observed. It is in the responsibility of the user to arrange proper disposal of the individual components.

All parts which may comprise potentially infectious materials have to be disinfected by suitable validated procedures (autoclaving, chemical treatment) prior to disposal. Applicable local regulations for disposal have to be carefully observed.

The instruments and electronic accessories (without batteries, power packs etc.) must be disposed off according to the regulations for the disposal of electronic components.

Batteries, power packs and similar power source have to be dismounted from electric/electronic parts and disposed off in accordance with applicable local regulations.

1.6 Instrument Disinfection

Analytical instruments for in vitro diagnostic involve the handling of human samples and controls which should be considered at least potentially infectious. Therefore every part and accessory of the respective instrument which may have come into contact with such samples must equally be considered as potentially infectious.

Before doing any servicing on the instrument it is very important to thoroughly disinfect all possibly contaminated parts. Before the instrument is removed from the laboratory for disposal or servicing, it must be decontaminated. Decontamination should be performed by authorised well-trained personnel only, observing all necessary safety precautions. Instruments to be returned have to be accompanied by a decontamination certificate completed by the responsible laboratory manager.

If a decontamination certificate is not supplied, the returning laboratory will be responsible for charges resulting from non-acceptance of the instrument by the servicing centre, or from authority's interventions.

1.7 Biohazard warning

Analytical instruments for in vitro diagnostic application involve the handling of human samples and controls which should be considered at least potentially infectious. Therefore every part and accessory of the respective instrument which may have come into contact with such samples must equally be considered as potentially infectious.

For safety reasons, we have labeled instruments with the „BIOHAZARD“ warning label below.

FIGURE 1
Biological Hazard Symbol

Notes:

2 THE ANALYZER - HUMASTAR 300

2.1 General Description

HUMASTAR 300 – is an automatic Random Access Clinical Chemistry Analyzer.

HUMASTAR 300 – with its sophisticated updated software offers great versatility and speed of operation. Its unique characteristics and user friendliness make this analyzer the top in its class with its productivity and throughput of 300 Clinical Chemistry tests plus 180 ISE tests per hour.

FIGURE 2

2.2 Main Characteristics

HUMASTAR 300 is an automatic Random Access Clinical Chemistry analyzer fully controlled by a MASTER computer (industrial Pentium) and three CPU slaves. Smart operation, where all the required test for Patient #1 are processed before starting on Patient #2, with an immediate print-out of the Patient report.

Speed: 300 test/h independently of method used, including 180 electrolytes with the built-in ISE module.

SAMPLE CAPACITY: 40 PRIMARY TUBES or small plastic sample cups; including 16 places reserved for Standards and Controls, plus 4 places for STATS. Possibility to add samples continuously during operation, up to 240 Patients with up to 30 different chemistries can be processed at a time.

REAGENT CAPACITY: 30 On-line reagents. Both 50 ml reagent bottles and 8 ml reagent tubes are placed in the Reagent plate. Each reagent container can be individually cooled or left at room temperature.

REAGENT VOLUME: Is automatically monitored with an On-line inventory The number of tests available in each reagent container is displayed on the monitor..

OPEN SYSTEM: an unlimited number of user programmable Chemistry and Immunoassay methods can be programmed.

AUTOMATIC PRE-DILUTION OF SAMPLES: upon request, with 15 different dilution ratios.

BAR CODE READER built-in to identify the samples and /or reagents. (optional).

WALK-AWAY OPERATION: once patients are programmed, all operations are fully automatic. The reaction cuvettes are automatically washed and dried to assure a non-stop operation.

INCUBATION takes place in quartz cuvettes immersed in a liquid bath at 37°C to assure perfect temperature control of the reactions at all times.

DIRECT READING: a built-in multi-filter photometer measures the samples directly in their cuvettes, several times during incubation at 8 different wavelength. Each sample has its own reagent-cuvette blank measured before the addition of sample.

I.S.E MODULE: (optional) built-in for the simultaneous determination of Sodium, Potassium and Chloride.

AUTOMATIC REPETITION OF TESTS – results that are critical, outside of linear range or due to substrate depletion are automatically pre-diluted and repeated.

REAGENT VOLUME: 300 µl of reagent is sufficient to run any test.

LIQUID LEVEL SENSOR: both the reagent and Sampling Probes have built-in liquid sensors and mixer to assure a correct sample preparation.

KEYBOARD: a full keyboard for easy programming of patients with demographics, including a mouse for easy operation and navigation inside the software.

SOFTWARE: user friendly software with graphic presentation guides the operator step by step through all operations.

HELP ON-LINE: special program to assist the operator at all times during programming and operation.

ON-LINE QUALITY CONTROL: Program checks the precision during standardization and daily operation. Controls are displayed over a period of 60 days, including graph, Mean value, S.D. and %CV.
STATS: an INTELLIGENT STOP enables to introduce a STAT sample at any time and report its result within only 12 minutes, without interfering with the normal routine operation.

PATIENT REPORTS: are user personalized on a 80 column printer. All result data is automatically memorized on the built-in hard disk and available for future consultation.

PRINT ON LINE: if activated it will print results immediately after their final measurement.

GRAPHIC DISPAY: possibility to view the curve of any test for each individual patient as well as all calibration and Quality control curves.

TEST COUNTER: displays the number and the type of test performed on the analyzer.

MANUAL INPUT OF RESULTS – for tests performed manually or on other instruments to be presented on the final Patient Report.

ARCHIVE ERRORS: a list of errors and warnings of the last 90 days are displayed.

COMMUNICATION: in real time with HOST computer according to ASTM protocols.

BI-DIRECTIONAL INTERFACE: via a built-in serial port RS 232/C connection to EDP systems.

2.3 Operation

The analyzer is a self sufficient system that uses some peripherals, such as Monitor, Mouse, keyboard and printer.

The analyzer consists in three parts:

- **Reagent Plate Chamber:** plate containing 30 On-line reagents with a choice to cool or leave the reagents at room temperature.
- **Sample Plate:** consisting of 4 segments each holding 10 primary tubes and 10 small plastic cups for automatic pre-dilution. The center of the plate is reserved for 4 STATS, and 16 places for Standards and controls.
- **Analytical System:** consists of a reaction plate with 39 quartz cuvettes, sitting in a liquid bath at 37°C. A built-in multi-filter photometer measures the mAbs of the samples directly in the cuvettes. A built-in Wash system automatically washes and dries the cuvettes after use for a continuous operation.

A reagent probe (with a built-in liquid level sensor) aspirates the reagent and transfers it into the quartz reaction cuvette. The Reagent is incubated in the liquid bath at 37°C for 90 sec. During its incubation time, it is measured (this becomes the reagent/cuvette BLANK for each test).
The Sampling Probe (with its built-in liquid level sensor and mixer) aspirates and deposits the sample by mixing i into the warm reagent to start the reaction.
Both Sampling and the Reagent arms are automatically washed both internally and externally, dried and are ready to prepare the next sample.
The 12 seconds operational cycle consists in:

- **A)** Reagent aspiration, dispensing and measurement Reagent/Cuvette BLANK
- **B)** Sample aspiration, dispensing, mixing, a sample measurement
- **C)** A final sample measurement and calculation
- **D)** Wash and dry cuvette
- **E)** Measurement of 20 samples in each cycle. (Each sample is measured every 24 sec – 2 working cycles)

The operation is Patient Oriented. All tests for Patient ONE are prepared before starting on patient TWO. A full patient report is printed as soon as all the result data for a given patient are available.

All patient data as well as the analyzer calibrations and their graph are stored on a hard disk. A built-in user friendly Help and Maintenance programs are a perfect guide for the operator.

2.4 User Warranty

HUMAN warrants that instruments sold by it or by one of its authorized dealers shall be free of any defect in material or workmanship, provided that this warranty shall apply only to defects which become apparent within one year from the date of delivery of the new instrument to the purchaser.
HUMAN shall replace or repair any defective item in its factory in Rome at no charge, except transportation changes. Instruments for repair have to be sent to HUMAN with all transportation charges prepaid.
This warranty excludes HUMAN from liability to replace any item considered as expendable in the course of normal usage, e.g.: lamps, valves, syringes, fuses, diskettes, monitor, tubing etc.
HUMAN shall be relieved of any liability under this warranty if the product is not used in accordance with the manufacturer‘s instructions, not regularly maintained, used with equipment not approved by HUMAN or used for purposes for which it was not designed.
HUMAN shall be relieved of any obligation under this warranty, unless:

1. A completed installation /warranty registration form is received by HUMAN within 15 days of installation of this product.
2. The Buyer, within the applicable period of time, returns the defective product or part thereof, freight pre-paid at Buyer‘s expense, to HUMAN.

This warranty does not apply to damages incurred in shipment of goods. Any damage so incurred shall be reported to the freight carrier for settlement or claim. HUMAN reserves the right to reject any warranty claim on any item that has been altered or has been returned by non-acceptable means of transportation or packaging. In all cases, HUMAN has the sole responsibility for determining the causes and nature of the failure, Crony’s determination with regard thereto shall be final.

2.5 Installation

2.5.1 UNPACKING

Shipping and packing materials have been selected to provide maximum protection during transportation under normal handling conditions.

! Notice: Once the carrier has taken possession of the system for transportation from the factory, carrier assumes all liability until delivery. All claims for damage due to transportation must be filed with the carrier as soon as possible.

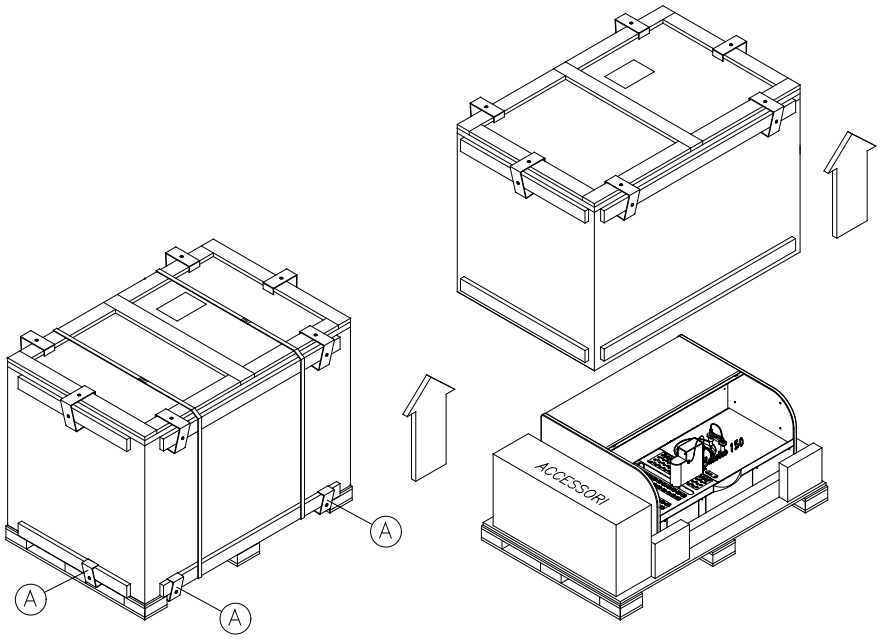


FIGURE 3
Shipping crate

! The system serial number is identified as the serial number of the Analyzer.

Examine the shipping cartons for indications of damage, e.g. crushed or indented walls, holes or gouges, water damage, etc. Have the carrier note any such damage on the delivery receipt; this will simplify formulating a claim if any of the instruments or parts are damaged.

Open the carton from the top and remove the instrument with care. As shown on the graph above. It is recommended that two people help with the removal of the instrument from its carton and plastic bag. Save all cartons and packing material until you are sure you have received everything and all is in good working condition.

2.5.2 INSTALLATION

The Analyzer system must be installed in the laboratory by specialized personnel. At the time of installation the system will be checked to ensure proper operations. During installation, at least one person in the laboratory will be trained in operation and maintenance of the ANALYZER.
The HUMASTAR 300 a highly sophisticated, high precision, sensitive instrument. Proper installation will ensure optimum performance.

2.5.3 ENVIRONMENTAL REQUIREMENTS

The system should be mounted on a table or workbench in an area free from vibration, draughts, dust, strong magnetic fields or direct sunlight.1.4.4.

2.5.4 LIVEL SETTING OF ANALYZER

The Analyzer has four adjustable pins indicated as **PK n°4** in „Figure 4“. The pins have to be adjusted to make sure that the analyzer sits perfectly level on its table top.

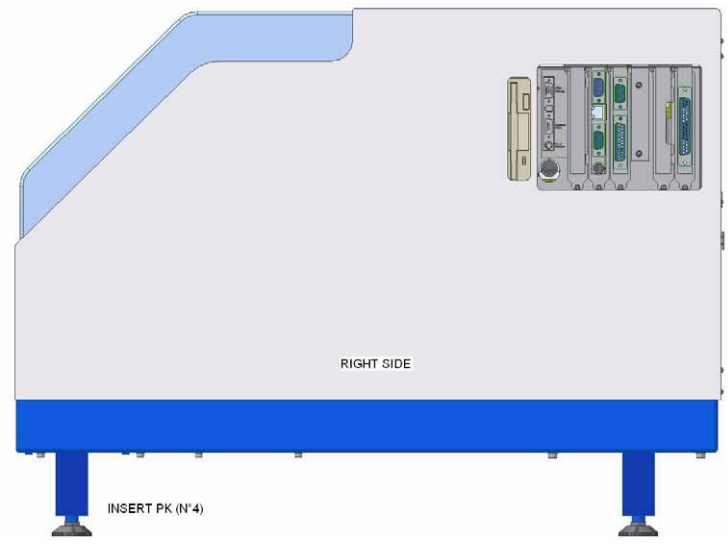


FIGURE 4
Right side view

2.5.5 OPERATING-TEMPERATURE-LIMITS

Ambient room temperature 15° C to 32° C
max. humidity 65% (non-condensing)

2.5.6 POWER REQUIREMENTS

A standard 230 Volt/50 Hertz or 115 Volt/60 Hertz - 400 Watts power is required, as indicated on the back of the instrument. A 3-wire outlet is used to assure proper electrical grounding.
If the laboratory power supply varies by more than 10%. It is recommended to install an external stabilizer an UPS no break with a minimum rating is 500 VA.

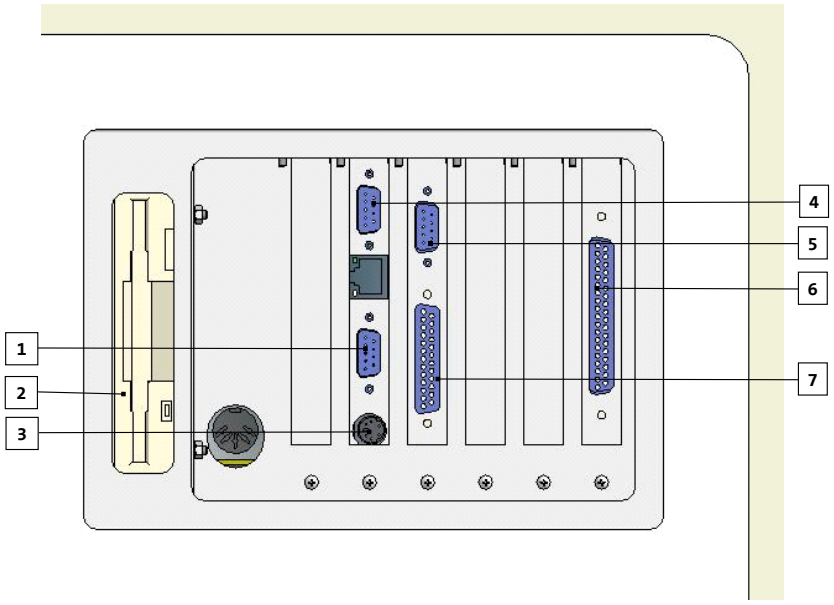
2.6 Assembly Procedure

The ANALYZER is supplied assembled and ready to use. However, it is important that the installation be done by authorized personnel only.
The instrument should be internally examined to check that no damage has occurred to any of the electronic boards or mechanical parts during shipment.
Then proceed to install the external parts as follows: Monitor, Printer, Mouse, Keyboard, (see „Figure 5“), Waste Container, Wash Solution Container, Container of liquid for the Incubation Bath (see „Figure 6“).
The Monitor and the printer can be connected to the outlets AUX located in the back of the analyzer.

2.6.1 EXTERNAL CONNECTIONS

Connect the monitor, keyboard, mouse and printer on the right side of the analyzer as shown in „Figure 5“:

FIGURE 5
External Conncections



1 Com 1 Host
2 Diskette
3 Mouse Keyboard
4 Monitor
5 Com 2 Host
6 Serial Port
7 Printer

2.6.2 CONNECTIONS IN THE BACK OF THE ANALYZER

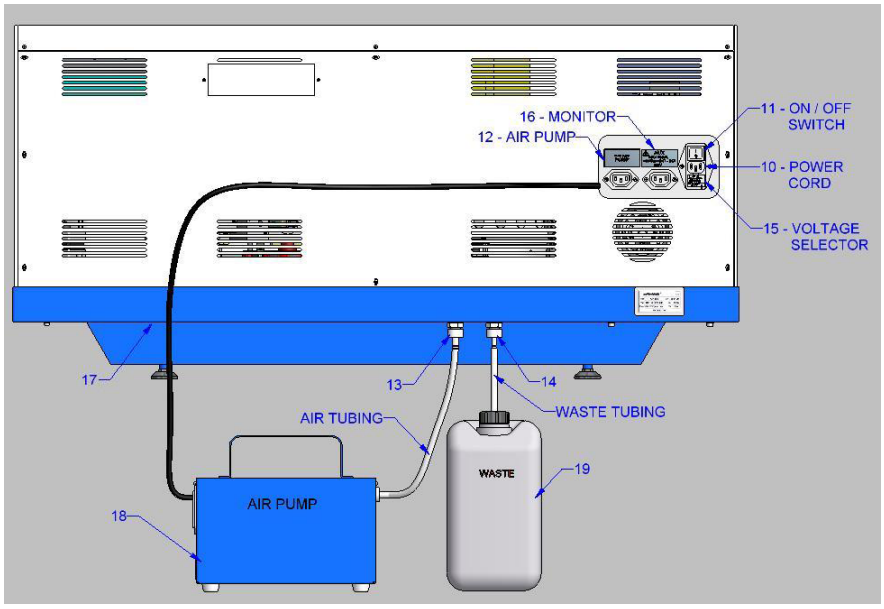
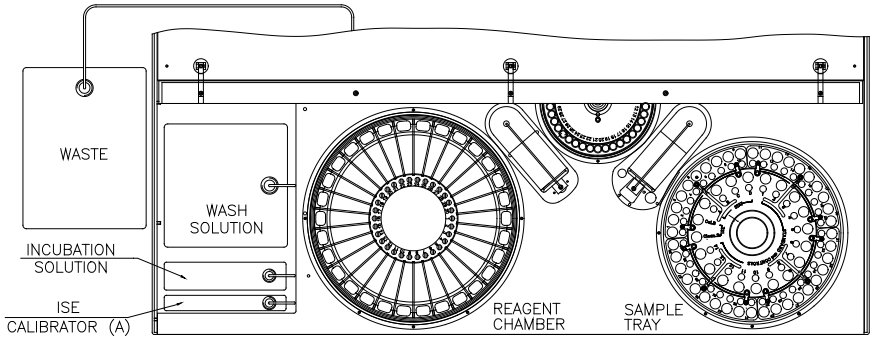


FIGURE 6
Connections in the back of Analyzer

1. Power supply input socket (10). Make sure there is a proper GND.
2. Power Switch ON/OFF (11).
3. Power input socket for AIR PUMP (12).
4. Inlet AIR PUMP tubing (13).
5. Outlet tubing to WASTE container (14).
6. Voltage Change (15) to select voltage 220 or 110 volt.
7. Auxiliary power supply socket (16).
8. Power supply cable for the ISE module to be connected to an outside power plug (17). The ISE module has to be always ON, since it requires continuous auto-calibration and to keep the electrodes moist, even when the analyzer is turned OFF.
9. AIR PUMP (18).
10. WASTE container (19), suggest to empty daily.

2.6.3 HYDRAULIC CONNECTIONS

FIGURE 7
Hydraulic Connections



! Note: Use only bi-distilled water for the incubation bath.

Connect as „Figure 7“, Waste container, Wash Solution, Liquid for incubation bath.

WASH SOLUTION: Fill container with 5 liters of dist. water and add 3 drops of **Tween 20**. Mix slowly by inverting to avoid foaming. Close the container with its screw cap containing e level sensor. It will be flagged when the solution level in the container gets low, however, there will be enough solution to finish the programmed workload. It is suggested to prepare the Wash Solution fresh every day and add to the container as necessary.

a) Once a week it is suggested to rinse thoroughly the Wash Container with distilled water before adding the freshly prepared Wash Solution.

INCUBATION BATH - Fill the container with bi-distilled water and close it with its screw cap and its level sensor.

a) When the Analyzer is turned ON, the incubation bath will be automatically filled including its thermostat. Both the temperature and the level of liquid in the incubation bath are continuously monitored. Missing bi-distilled water in the bath is automatically signaled and flagged.
b) To avoid formation of bacteria or other undesirable matter inside the water bath, it is important that every two weeks this bi-distilled water be drained and fresh one introduced. This operation is done automatically through the Maintenance program. Simply press first Empty and then Fill Bath. ,

2.7 Analyzer Components

2.7.1 MONITOR

HUMASTAR 300 can operate with every type of monitor (CRT or LCD) as long as it has a 15 pin VGA connector. The monitor with the help of the graphic software will guide the operator step by step through all operations. When needed click on (?) HELP a detailed help page will be displayed.

2.7.2 TOP VIEW OF THE ANALYZER

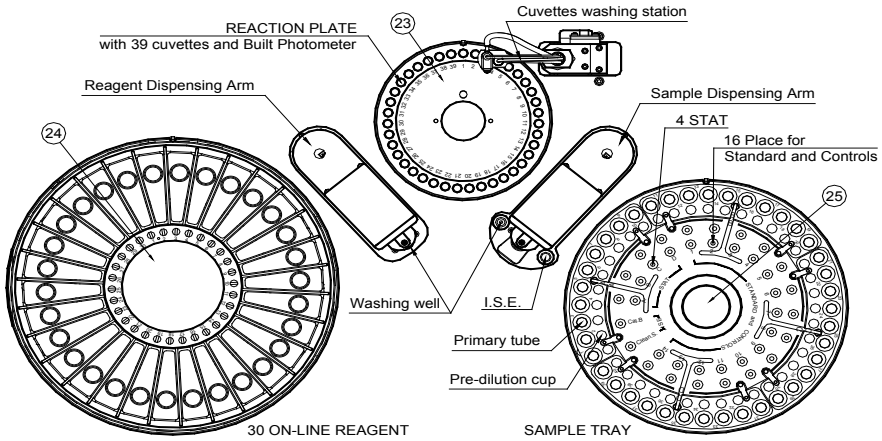


FIGURE 8
Top view

The operational system consists in:

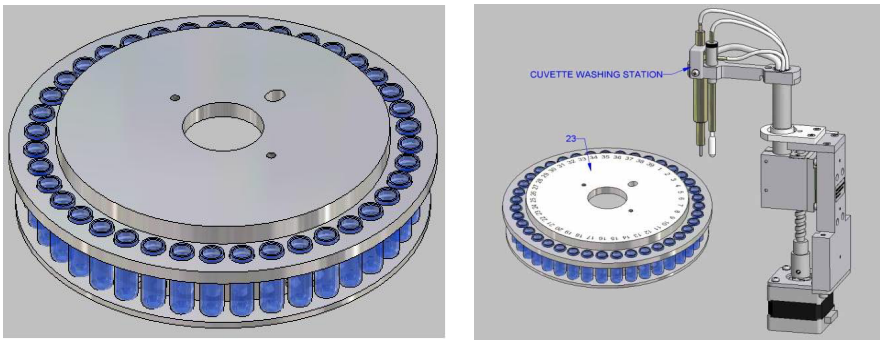
- Analytical Plate
- Reagent Chamber
- Sample Plate.

2.7.3 ANALYTICAL PLATE

The reaction plate consists in 39 quartz cuvettes immersed in a 37°C liquid bath. A built-in photometer and an automatic cuvette washing station for a non-stop operation. Samples are prepared, incubated and measured directly in those cuvettes at 8 different wavelengths.

The continuously circulating water in the incubation bath is controlled by a built-in thermostat to exactly 37°C ± 0.2°C.

FIGURE 9
Analytical System



Analytical plate

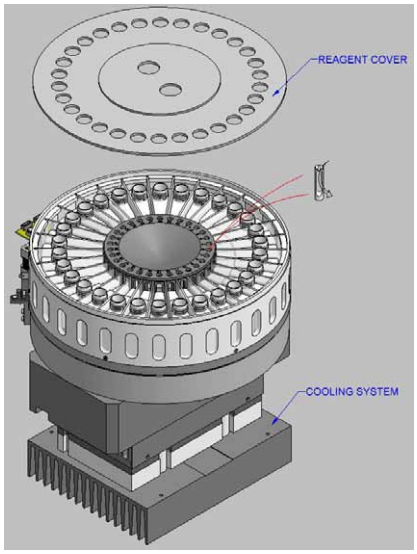
2.7.4 REAGENT CHAMBER

The reagent plate is devided into 30 compartments to contain 50 ml reagent bottles. l (**cod. 17950/S**) or 5 ml (**cod. 17905/S**) by means of an adaptor (cod. 17906/S).

Cooling can be selected individually for each reagent, by opening a window to let forced cool air to penetrate. For reagents at room temperature, the window remains closed. The selection is made by turning the device located next to each reagent position number.

Each container has a built-in transparent window for automatic identification by a bar code reader. For more details see section “Bar Code Reader” Optional module).

FIGURE 10
Reagent Chamber



2.7.5 REAGENT ARM

The Reagent Arm holds the Probe which is connected to the diluter. The Probe aspirates the reagent and deposits it into the reaction cuvette. The Arm has three positions: Reagent bottle – reaction cuvette – washing well. The Reagent Probe has a built-in liquid level sensor, which determines the volume of reagent in each Reagent Bottle, which in turn is converted into number of tests present in each bottle according to the requirements of the particular test. When there is insufficient reagent in the bottle it will be flagged.
When adding a second reagent, the Probe becomes also a mixer, which enters the reaction cuvette to mix the solution with the freshly added reagent.

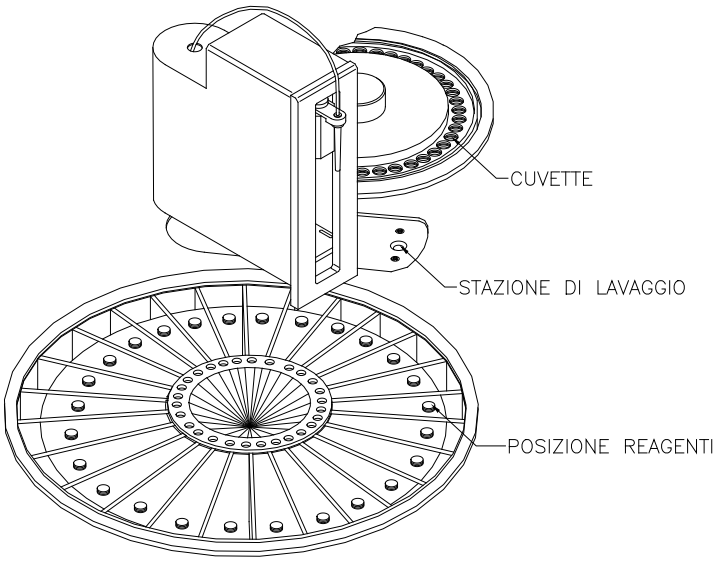
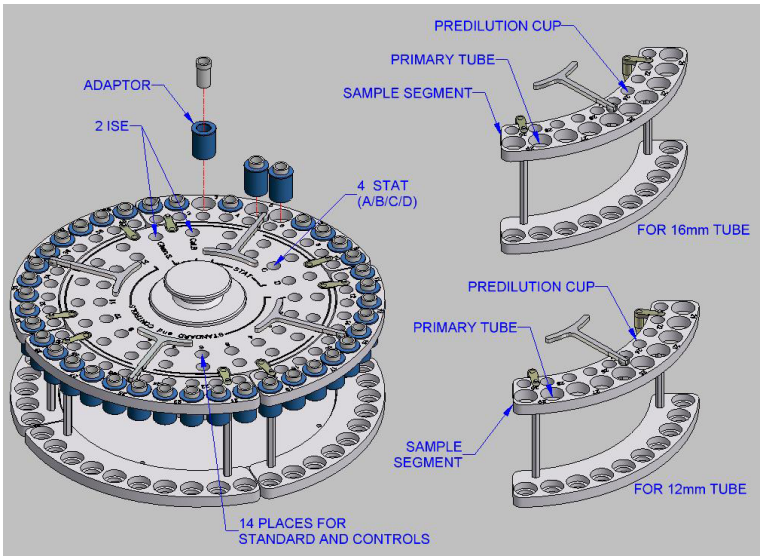


FIGURE 11
Sampling Arm of Reagent System

2.7.6 SAMPLE TRAY

The Sample Tray consists of a central body surrounded by four segments with 10 places each for Patient primary tubes and a small pre-dilution cups. The central part contains 4 places for STATS and 16 places for Standards and Controls, each of them has a corresponding place for a pre-dilution cup.

FIGURE 12
Sample Tray



The central part contains:

- 14 positions for **Standards** and **Controls** plus 14 for pre-dilution cups
- 4 positions for **STATS** plus 4 pre-dilution cups
- 2 positions for ISE **Calibrator B** and a **Clean** solution for the electrolytes.

	RACK A	RACK B	RACK C	RACK D
For primary tube - 10ml	17960/1	17960/2	17960/3	17960/4
For primary tube - 5ml	17961/1	17961/1	17961/1	17961/1

The segments are available for primary tubes of 16x100 and 12.5x75 mm.
The pre-dilution cups are available from HUMAN. Code 18720/31.
Sample ID can be programmed manually using a Bar Code Reader, or an optical pen.

2.7.7 SAMPLING ARM

The sampling Probe is connected to the Diluter to aspirate the sample to be analyzer from the Sample Plate and transferred into the reaction-cuvette and mix it with the warm reagent. The sampling Arm moves to several positions:

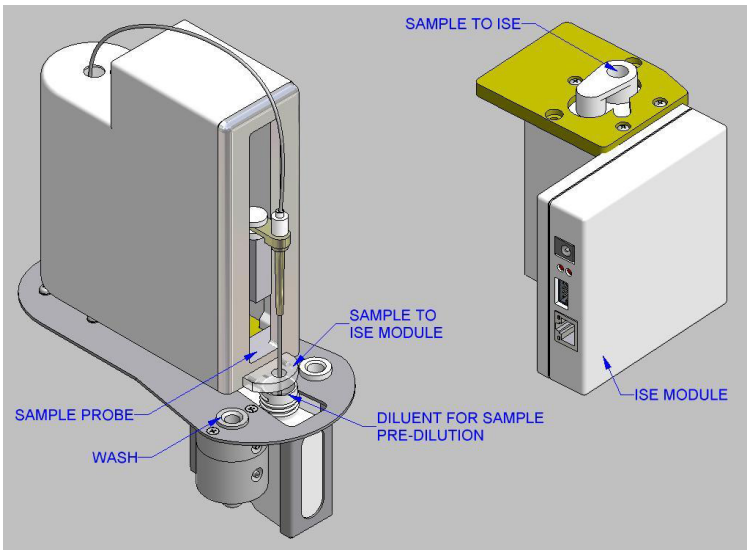


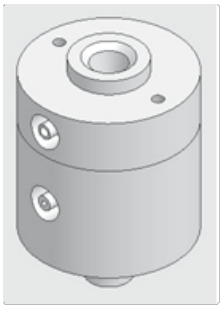
FIGURE 13
Sampling Arm

- To all the sampling positions in the Sample Plate.
- To the pre-dilution liquid bottle
- To the Reaction Cuvettes
- To the Washing well
- To the ISE module

The Sampling Probe has a built-in liquid level sensor to detect the presence of the sample in its tube. Should the level of sample be inadequate, it will FLAG the massage of Missing Sample.

2.7.8 PROBE WASHING WELL

FIGURE 14
Washing Station



The washing and cleaning of the Probe is important to avoid carryover or contamination. After each operation the Probe enters the Washing well, where it is washed internally by Pump P1 and externally by Pump P P5 with wash solution and finally it is dried externally by an air jet to eliminate any wash residue or drops.

2.7.9 SAMPLE AND REAGENT DILUTER

There are two high precision diluters.
One to dispense the Reagent and another
one to aspirate the sample and dispense it into the reaction cuvette.
The programmable volumes are:

- **Sample:** from 3 to 70 µl
- **Reagent**: from 3ul to 500 µl
- **Second Reagent:** 3ul to 300 µl

with increments of 1 µl.

For the Reagent1 is possible to dispense lower volume to 300 µl only for methods **PreMix** and **Post R2**.
A peristaltic pump in series with the Diluter washes the Probes internally inside the Washing Wells after each operation.
By means of an air gap separation the
wash solution is never in contact with
the sample.
The wash volume has been optimized
to assure perfect cleaning with less
consumption of the wash solution (2,5 L/h).

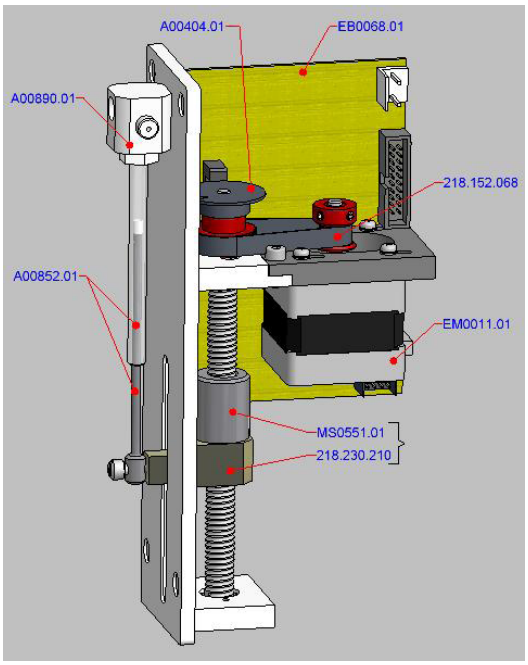


FIGURE 15
(17915 sample dilutor w syringe
17916 reagent dilutor w syringe

Reagent Syringe = 1000 µl max.
(cod. 17916/1 – syringe with piston)

Sample Syringe = 600 µl max.
(cod. 17915/1 – syringe with piston)

Syringe holder valve
(cod. 17917)

O-ring (cod. 17915/2)

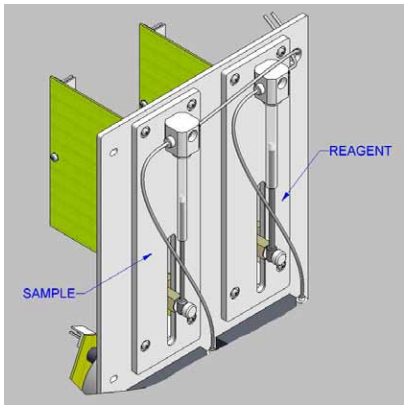


FIGURE 16
Diluters panel (front view)

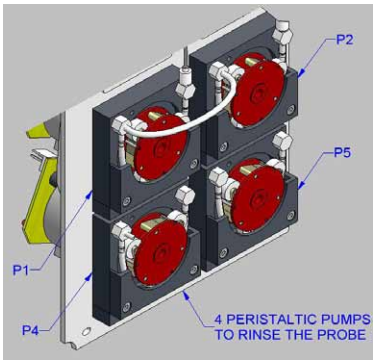
2.7.10 PERISTALTIC WASHING PUMPS

Below the Diluters are built-in four peristaltic pumps controlled by the CPU slaves.

Their function is:

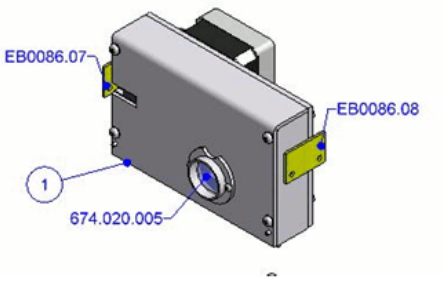
- **P1** – washes the inside of the Sampling Probe
- **P2** – washes the inside of the Reagent Probe
- **P4** – washes the outside of both of the above Probes
- **P5** – washes the reaction cuvettes

FIGURE 17
Peristaltic Pump



2.7.11 PHOTOMETER MODULE

Multi-filter photometer with built-in 8 narrow band interference filters, conceived to assure maximum sensitivity and accuracy to measure the samples directly in its reaction cuvettes. The following are the 8 standard wavelength filters: 340, 380, 405, 510, 546, 578, 620 and 700 nm.



2.8 Software

The HUMASTAR 300 software has been divided into 8 parts in order you make it easy and user friendly for the operator, all smartly enclosed in a book form.
Detailed information and procedures are described in the “Operator’s Manual”.

3 OVERALL BLOCK DIAGRAMM (P/N: EI0110.01)

TECHNICAL DESCRIPTION

This Block Diagram is the basic guide to find all the necessary information about the Analyzer. It shows graphically all the connections between the modules and the PCB's.

DOCUMENTATION

EI0110.01.0.DW (block diagram)

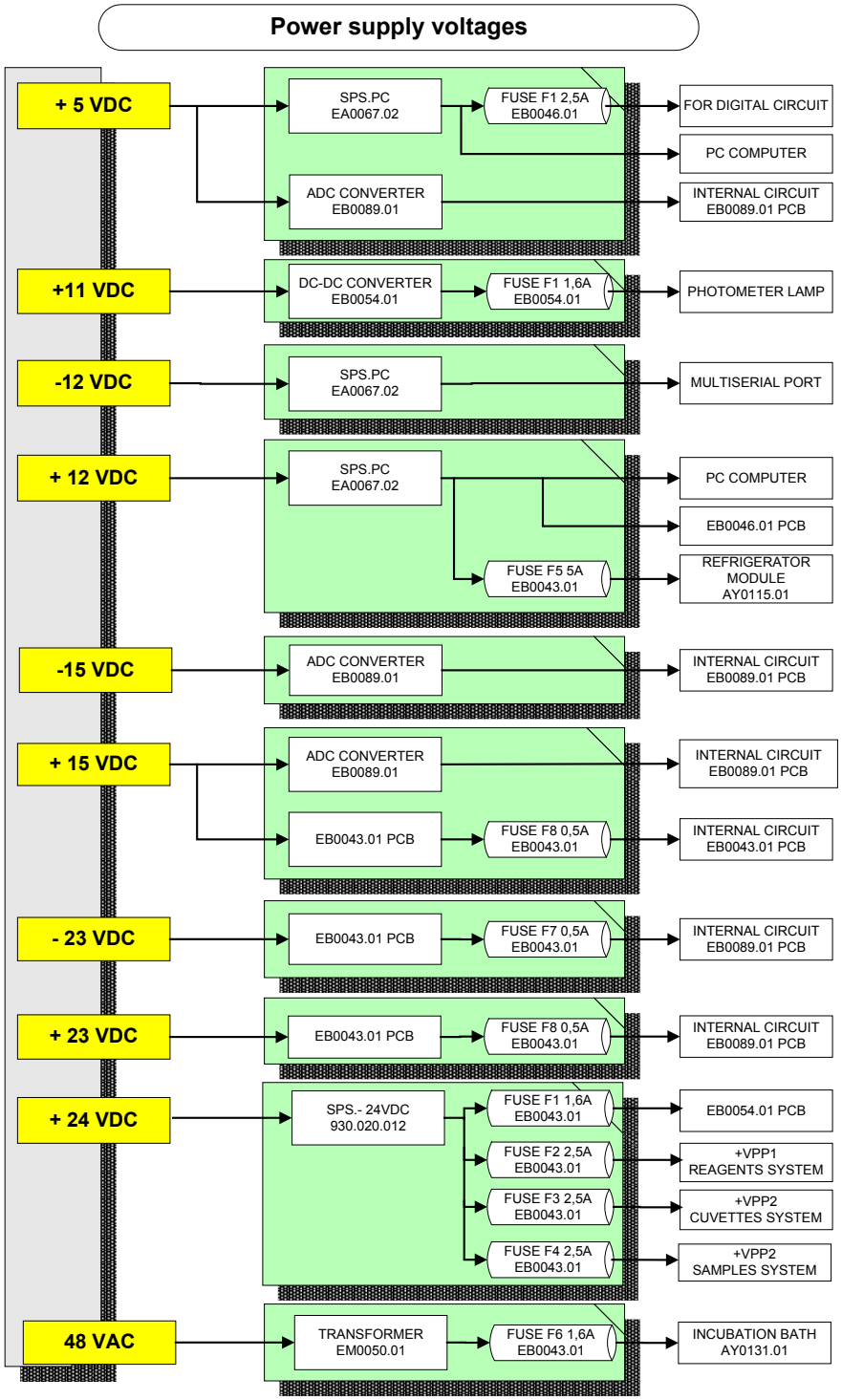
3.1 Power Supply Connections (P/N:EI0107.01)

TECHNICAL DESCRIPTION

This diagram includes all the power supply connections.
The diagram " Power supply voltages " is displayed on the next page.

DOCUMENTATION

EI0107.01.0.DW (block diagram)
EI0107.01.0.SC (electrical diagram)


Power supply voltages
+ 5 VDC
SPS.PC
EA0067.02
FUSE F1 2,5A
EB0046.01
FOR DIGITAL CIRCUIT
PC COMPUTER
ADC CONVERTER
EB0089.01
INTERNAL CIRCUIT
EB0089.01 PCB
+11 VDC
DC-DC CONVERTER
EB0054.01
FUSE F1 1,6A
EB0054.01
PHOTOMETER LAMP
-12 VDC
SPS.PC
EA0067.02
MULTISERIAL PORT
+ 12 VDC
SPS.PC
EA0067.02
PC COMPUTER
EB0046.01 PCB
FUSE F5 5A
EB0043.01
REFRIGERATOR
MODULE
AY0115.01
-15 VDC
ADC CONVERTER
EB0089.01
INTERNAL CIRCUIT
EB0089.01 PCB
+ 15 VDC
ADC CONVERTER
EB0089.01
INTERNAL CIRCUIT
EB0089.01 PCB
EB0043.01 PCB
FUSE F8 0,5A
EB0043.01
INTERNAL CIRCUIT
EB0043.01 PCB
- 23 VDC
EB0043.01 PCB
FUSE F7 0,5A
EB0043.01
INTERNAL CIRCUIT
EB0089.01 PCB
+ 23 VDC
EB0043.01 PCB
FUSE F8 0,5A
EB0043.01
INTERNAL CIRCUIT
EB0089.01 PCB
+ 24 VDC
SPS.- 24VDC
930.020.012
FUSE F1 1,6A
EB0043.01
EB0054.01 PCB
FUSE F2 2,5A
EB0043.01
+VPP1
REAGENTS SYSTEM
FUSE F3 2,5A
EB0043.01
+VPP2
CUVETTES SYSTEM
FUSE F4 2,5A
EB0043.01
+VPP2
SAMPLES SYSTEM
48 VAC
TRANSFORMER
EM0050.01
FUSE F6 1,6A
EB0043.01
INCUBATION BATH
AY0131.01

3.2 Main Power Supply Assembly (P/N: AY0097.04)

TECHNICAL DESCRIPTION

This section describes all the Power Supply parts.
The module generates the following voltages:

- + 5.0 V
- - 5.0 V
- + 12 V
- - 12 V
- + 24 V
- 18 Vac
- 48 Vac
- 230/115 Vac – Air Pump
- 230/115 Vac - AUX

DOCUMENTATION

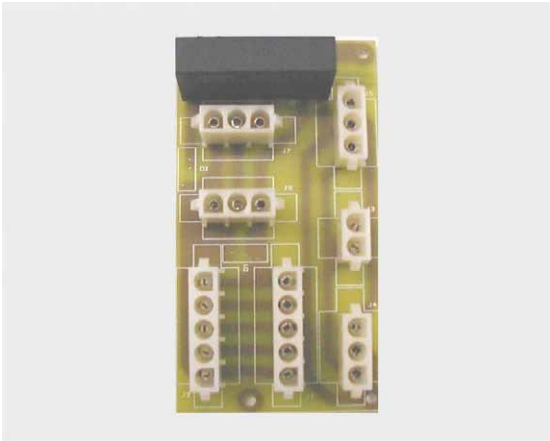
EI0107.01.0.DW (Block diagram)
EI0107.01.0.SC (Electrical diagram)

3.2.1 PCB POWER DISTRIBUTION (P/N: 17970/27)

TECHNICAL DESCRIPTION

This board distributes the primary voltages to the following devices:

- Power switch
- Primary to transformer T1
- Secondary S4 of transformer T1
- PC power supply
- AUX power supply plug
- Power supply +24 V
- Air Pump (operated by optotriac OC1 and controlled by PCB 17970/7)



DOCUMENTATION

17970/27.B.SC (electrical diagram)
17970/27.A.PM (assembly drawing)

3.2.2 TRANSFORMER (P/N: EM0050.01)
TECHNICAL DESCRIPTION

The transformer T1 becomes a galvanic separator and has two primaries both at 230 and 115 Vac.

Primary (PH1 - PH2) 230/115 Vac
- Secondary (S1+S2) 18-0-18 Vac
- Secondary (S3) 48 Vac
- Secondary (S4) 230 Vac

DOCUMENTATION
EM0050.01.B.SC (electrical diagram)

3.2.3 PC POWER SUPPLY (P/N: 17956/1)
TECHNICAL DESCRIPTION

Module **17956/1** is a PC power supply, inside it contains a PCB EB0104.02 that generates a delayed voltage (150ms) of +5V to supply some µ-controllers.

The Power Supply has the following voltages:
+ 5V ± 0,25 stabilized for the computer board
+ 5V ± 0,25 (delayed) stabilized for the digital circuits
- 5V ± 0,25 stabilized, Not used
+ 12V ± 1 stabilized for the refrigeration module, µ Processor and the PC computer.
- 12V ± 1 stabilized for the multi-serial PCB.

DOCUMENTATION
EA0067.02.0.SC (electrical diagram)

3.2.4 POWER SUPPLY + 24V (P/N: 17956/2)

TECHNICAL DESCRIPTION

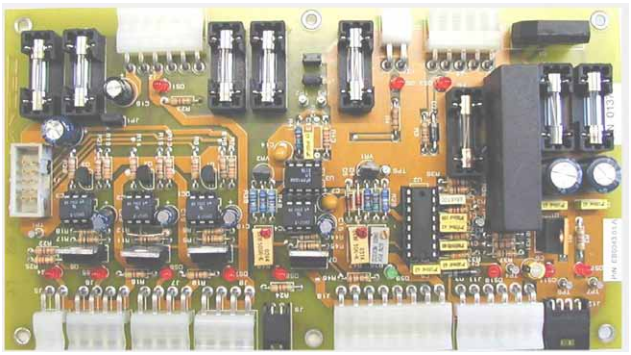
This module is supplied from the secondary 230V transformer EM0050.01 and supplies the stabilized + 24V for the motors and to the power supply of the photometer lamp.

3.3 Power Supply Board (P/N: 17970/7)

TECHNICAL DESCRIPTION

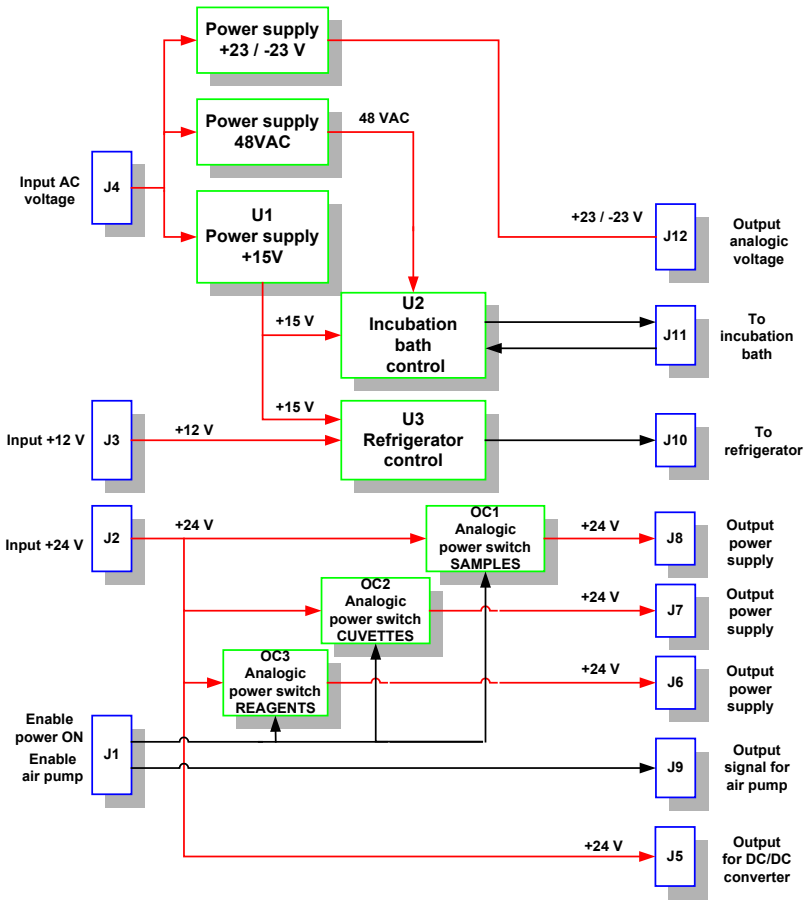
The function of this board is to:

- To supply (+24V) to the stepper motor circuits, by means of the analogical switches (OC1, OC2, OC3).
- To enable and control the temperature inside the thermostat by means IC U2.
- To enable and control the refrigeration module (IC U3).
- The following voltages are divided by the fuses:



  - [+24] power supply photometer lamp.
  - [+24] controls the power supply of the **Sample System**
  - [+24] controls the power supply of the **Analytical System** (Cuvettes)
  - [+24] controls the power supply for the **Reagent System**
  - [+12] controls the refrigeration module.
  - Input voltage to generate [+15 V].
  - Input voltage to generate [- 15 V].
  - [48 Vac] controls the thermostat (incubation bath)

Block diagram EB0043.01



This board supplies the following voltages:

+23 ± 2 V	not stabilized +15V for the A/D converter board.
-23 ± 2 V	not stabilized -15V for the A/D converter board.
+15 ± 0,25V	stabilized for the analog circuits to control the temperatures in the incubation bath and the refrigeration module.
+12 ± 1 V	stabilized for the refrigeration module.
+24 ± 0,5V	stabilized for the motor driver modules and the photometer lamp.
48 ± 2 Vac	to supply the resistance inside the thermostat.

JP1	Closed
JP2	Closed
JP3	Closed

FIGURE 18
Setting Jumpers

Ref.	Test Point	Range	Note
1	TP3	< 2,75 V ± 0,05 Adj. R48	*
2	TP6	+5 V ± 0,1 Adj. R47	
3	TP5	+3,075 V ± 0,05 Adj. R26	
4	R38 side VR2	+5 V ± 0,1	
5	TP8	+25 V ± 3	
6	TP7	- 25 V ± 3	
7	Pin 15 U2	+15 V ± 0,3	
8	Fuse F5 - Pin 8 J10	+12 V ± 1	
9	Fuse F1, F2, F3, F4	+24 V ± 2	

FIGURE 19
Nominal voltages

* Adjust to the minimum value
All voltages are referred to GND = TP1

DOCUMENTATION
17970/7 .A.SC (electrical diagram)
17970/7 .B.PM (assembly drawing)

3.4 Power Supply Maintenance

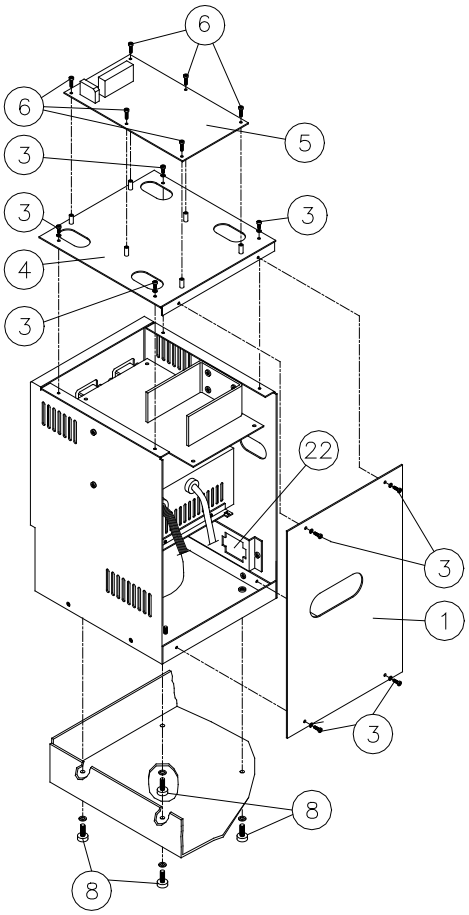
Operations to be performed with Analyzer turned OFF.
Remove the outside panels (see “General Maintenance” – paragraph - “To remove outside Panels”.
To follow the electrical connections, see diagrams (EI0107.01.SC e EI0107.01.DW) included in this section:

3.4.1 TO REMOVE THE POWER SUPPLY

1. Disconnect the two connectors (22) P/N: WC0105.01, „Figure 21“.
2. Remove the four screws (8) that hold it to the base. (hexa-key 4mm), „Figure 20“.
3. Disconnect connectors J1, J5, J6, J7, J8, J10, J11, J12 from the power supply board P/N: 17970/7 (5).
4. Remove the power supply assembly from the analyzer.

5. To access inside the power supply, remove screws (3) and its back panel (1).

FIGURE 20



3.4.2 REPLACEMENT OF THE PC POWER SUPPLY

1. Disconnect connectors J2, J3, J4 from board (5) see „Figure 20“, remove screws (3) from the top panel and remove the panel (4).
2. Remove the input connector of 220Vac (black cable) from J4 the distribution board (8), see „Figure 21“.
3. Remove the support with its connectors (22), see „Figure 20“ / „Figure 21“.
4. Remove the screws (16) holding the power supply (15) to its front panel, see „Figure 21“.
5. Replace the power supply and reassemble in reverse as described above.

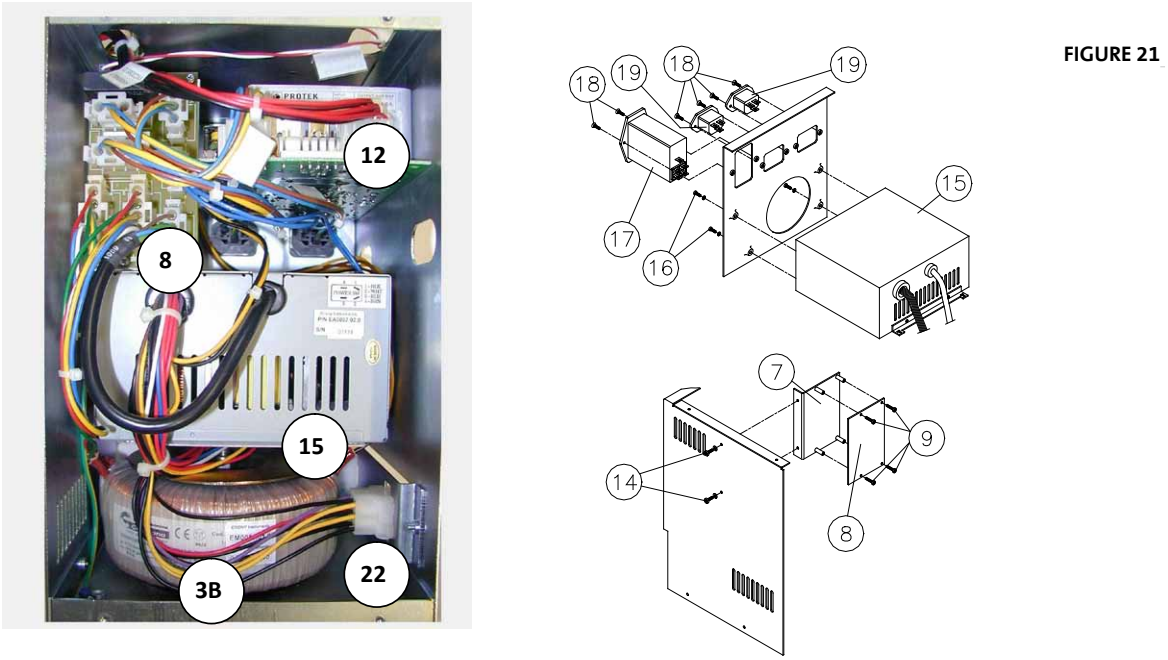


FIGURE 21

3.4.3 MAIN POWER SWITCH REPLACEMENT

1. Remove the two screws (18), see „Figure 21“.
2. Remove nut (11) holding the GND terminal (use a hexa key 7mm), see „Figure 22“.
3. Remove the connector from the cable between the filter and connector J1 board (8), see „Figure 21“.
4. Replace and reassemble in reverse as described.

3.4.4 FUSE REPLACEMENT

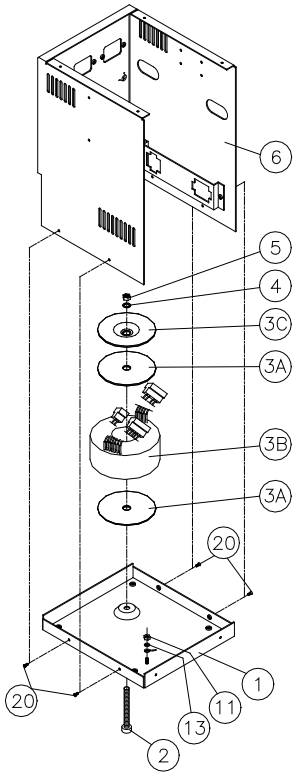
Use fuses as indicated on the name plate. Make sure to reinert the fuse container selecting the right voltage. Indicated by the symbol ▼.

Remove the power cord and extract the fuse container (17).

3.4.5 TO REPLACE TRANSFORMER

1. Disconnect connectors J4 from board (5), see „Figure 20“, disconnect cables from connectors J1, J3 from board (8), see „Figure 21“.
2. Remove container (6), take out screws (20) see „Figure 22“.
3. Unscrew nut (5) that hold the transformer (3B) to the base (use hexa key 13mm).
4. Remove disk (3C) and the isolation disk (3A).
5. Replace the transformer and reassemble in reverse as described above.

FIGURE 22



3.4.6 REPLACE POWER SUPPLY + 24V

1. Disconnect from the power supply (12) connectors P1, P2, see „Figure 23“.
2. Remove screws (14) and remove the board.
3. Replace the p.s. board and reassemble in reverse. (Make sure that connector P2 is inserted with its three r**ed wires** on the right side of the board (12). See the electrical diagram EI0107.01.SC).

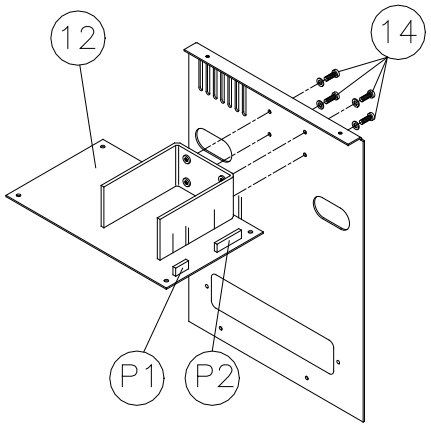


FIGURE 23

3.4.7 REPLACEMENT OF THE POWER DISTRIBUTION BOARD

1. Disconnect the connectors from the board (8), see „Figure 21“.
2. Remove screws (9) and board (8).
3. Replace board and reassemble in reverse.

3.5 Trouble Shooting Guide

This section lists a series of possible problems and how to solve them.
In order to identify some of these problems, it is necessary to use the Diagnostic Program “HUMASTAR 300 TOOLS“.

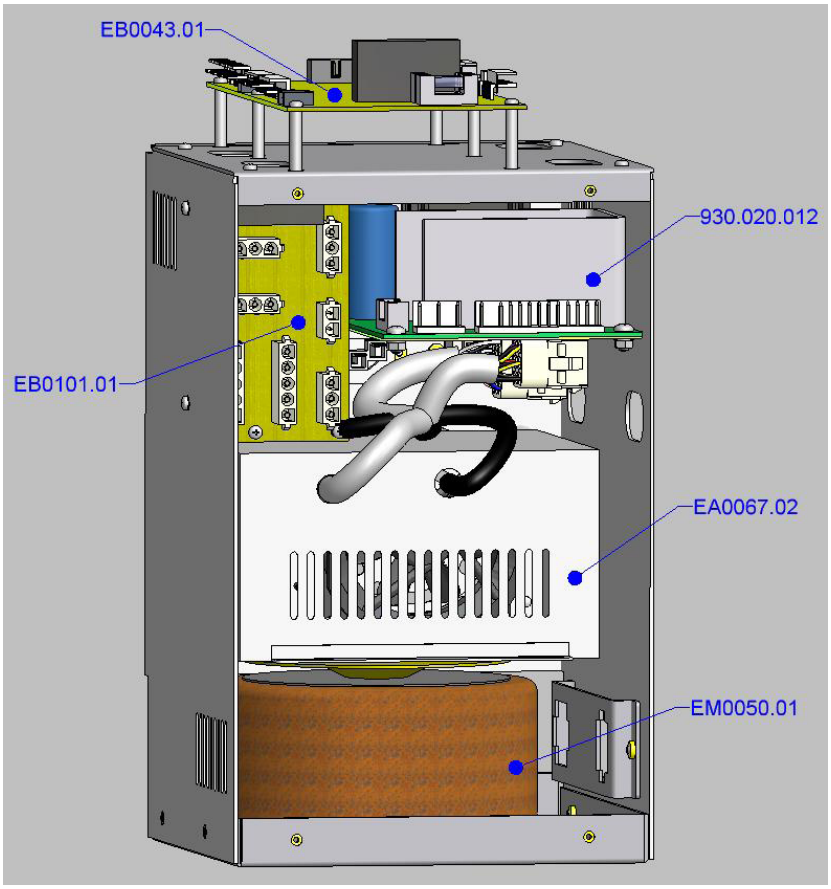
Defect	Causes and Remedies
Analyzer does NOT turn ON	- Make sure that the power cord is well inserted. - If the Monitor power cord is inserted to the analyzer, make sure to **Turn ON first the analyzer** and after the Monitor. - Make sure that the Monitor is turned ON. - Check the correct voltage

The fuses are frequently burnt	- Replace the fuses as described above. - Disconnect the cord that is connected to the AUX plug. Turn ON the analyzer. **If the problem persists:** - Disconnect all connectors J1, J2, J3, J4 from the power supply board **17970/7**. Turn ON the analyzer. - Disconnect connectors J1, J4 e J5 from the distribution board **17970/27**, turn On the analyzer - Replace distribution board **17970/27** - Replace switch EA0065.01
The computer does NOT turn ON	- Make sure that the red LED on the “back plane” board are ON. - Make sure that the fan of the µProcessor is working. - Remove the following connections: - P1, P2 back plane, P2/1 al HDD, P5 al FDD, P6 al J7 **17970/9** - Connect a charge of 10-20 ohm 5-10 W, between terminals 1-4 of P2/1 power supply module PC 17956/1 - Turn On the Power supply. If it does NOT turn ON - replace it. - Disconnect connectors P1 and P2 back plane (together), P2/1 at HDD, P5 at FDD, P6 at J7 **17970/9** one at a time to isolate the defective part.
Missing voltage +/- 23V	- Check fuses F7-F8 on board **17970/7** - Disconnect J12- **17970/7** - Check the voltage Vac on J4, board **17970/7** - Replace transformer EM0050.01
Missing voltage + 15V	- Check fuse F8, on board **17970/7** - Disconnect J12- **17970/7** - Check voltage Vac on J4, board **17970/7**, if needed replace transformer EM0050.01 - Replace board **17970/7**
Missing Voltage + 12V	- Check fuse F5, board **17970/7** - Disconnect J10- **17970/7** - Check the voltage Vdc on J3, board **17970/7** , if necessary replace PC power supply PC **17956/1**

Missing the + 24V in Sampling System	- Check the PWR ON voltage of the Sampling System. - Replace F4 - If fuse burns – disconnect J8 - Check voltage VDC on J2, board **17970/7**, if necessary replace the power supply +24V - **17956/2** - Replace board **17970/7**
Missing the + 24V in the Cuvette Measuring System	- Check the PWR ON voltage of the Cuvette System - Replace F3 - If fuse burns - disconnect J7 - Check voltage VDC on J2, board **17970/7**, if necessary replace power supply +24V - **17956/2** - Replace board **17970/7**
Missing the + 24V in the Reagent System	- Check the PWR ON of the Reagent System. - Replace F2 - If fuse burns – disconnect J6 - Check the voltage VDC on J2, board **17970/7** , if necessary replace the power supply +24V - **17956/2** - Replace board **17970/7**
Thermostat does NOT heat	- Check fuse F6 – F8 - Check PWR ON on the Cuvette Measuring System. - Check the voltage of 48 Vac between terminals 1-2 J11, on board **17970/7** , if necessary replace board **17970/7** - Check the resistance of 40 Ohm of the heating element EM0052.01, if necessary replace it. - Check the continuity of the cable - Check the voltage of 48 VAC between pin 4-5 J4 on board **17970/7**, if necessary replace the transformer EM0050.01 - Check the voltage on pin 10 of U2 < 1,5V, on board **17970/7** - Check voltage 15 VDC on pin 8 of U3, board 17970/7 - Check U1 - Check the voltage on TP6 = +5 V, if necessary adjust with R47, board **17970/7** - Check the voltage on TP5 > +3,07 < 3,08 V, adjust with R26, board **17970/7** - Check the voltage on TP4 < +3 V, board **17970/7**, if necessary replace sensor EA0098.01 - Check on pin 3 of OC5 a square wave with an amplitude of > 12 V, if absent, replace board **17970/7**

Refrigeration in Reagent Chamber does not cool.	- Check fuse F5 – F8 - Check voltage +12V between terminals 7-8 J10, board **17970/7** - Check +15V on terminal 8 of U3, on board **17970/7** - Check voltage on TP3 < +2,75V board **17970/7**, if necessary adjust with R48 - Check on terminal 7 of U3 and terminal 5 of OC4 < 1V board **17970/7**, if necessary replace board **17970/7** - Remove connector J10 and check the resistance of the Peltier between pin 4-5 of cable WC0127.01, about 2 Ohm, if necessary replace it. (cod. EA0072.01)
AIR PUMP motor does NOT work	- Check the connection of the power cord to the AIR PUMP. - Check the fuses. - Remove the power cord and check inside the pump that the motor fan moves freely. (Move manually the motor fan) - Check the voltage 230 or 115 Vac of the AIR PUMP. If necessary replace the board **17970/27**. - Make sure that the LED DS8 functions properly on the board **17970/7**, when turning the AIR pump ON/OFF. If necessary check pin 2 J9 a voltage of +5V (OFF) and 0V (ON) - Check operation of the CPU slave board **17970/8** (exchange with another board) - Replace board **17970/9**

3.6 Spare parts



! To assure a rapid and efficient technical service to its clients HUMAN suggests to keep in stock all the parts marked with the symbol (•). Order requests have to have the following information: Part Number or Code, Description and Quantity.

Code	Sub_Code	Description	QTY
AY0097.04		Power supply assembly complete with 17970/7 board	1
	17970/7	Power supply board	1
	17970/27	Power distribution board	1
	17956/1	PC power supply	1
	17956/2	Power supply +24V	1
	EM0050.01	Power Supply transformer	1
	EA0065.01	Switch with filter	1
	680.010.300	Fuse F7 - F8 - 0,5 A (Φ 5x20 mm)	2
	680.010.216	Fuse F1 - F6 - 1,6 A (Φ 5x20 mm)	2
	680.010.225	Fuse F2 - F3 – F4 - 2,5 A (Φ 5x20 mm)	3
	680.010.250	Fuse F5 – 5A (Φ 5x20 mm)	1

	680.010.250	Fuse (int.) **F5H250V** (Φ 5x20 mm) per 230 Vac	2
	680.010.280	Fuse (int.) **F8H250V** (Φ 5x20 mm) per 115 Vac	2
	EA0066.01	Power cord with AUX socket – for AIR PUMP	2
	WC0066.01	Power cord +24 V	1
	WC0067.01	Power cord 230 Vac	1
	WC0068.01	Power cord AIR PUMP signal	1
	WC0105.01	Power cord for PC	1
	910.004.004	Power cord for CD-ROM (optional)	1

3.7 Enclosed Documentation

3.7.1 EI0110.01.0.DW (BLOCK DIAGRAM)

3.7.2 EI0107.01.0.DW (BLOCK DIAGRAM)

3.7.3 EI0107.01.0.SC (ELECTRICAL DIAGRAM)

3.7.4 17970/27.B.SC (ELECTRICAL DIAGRAM)

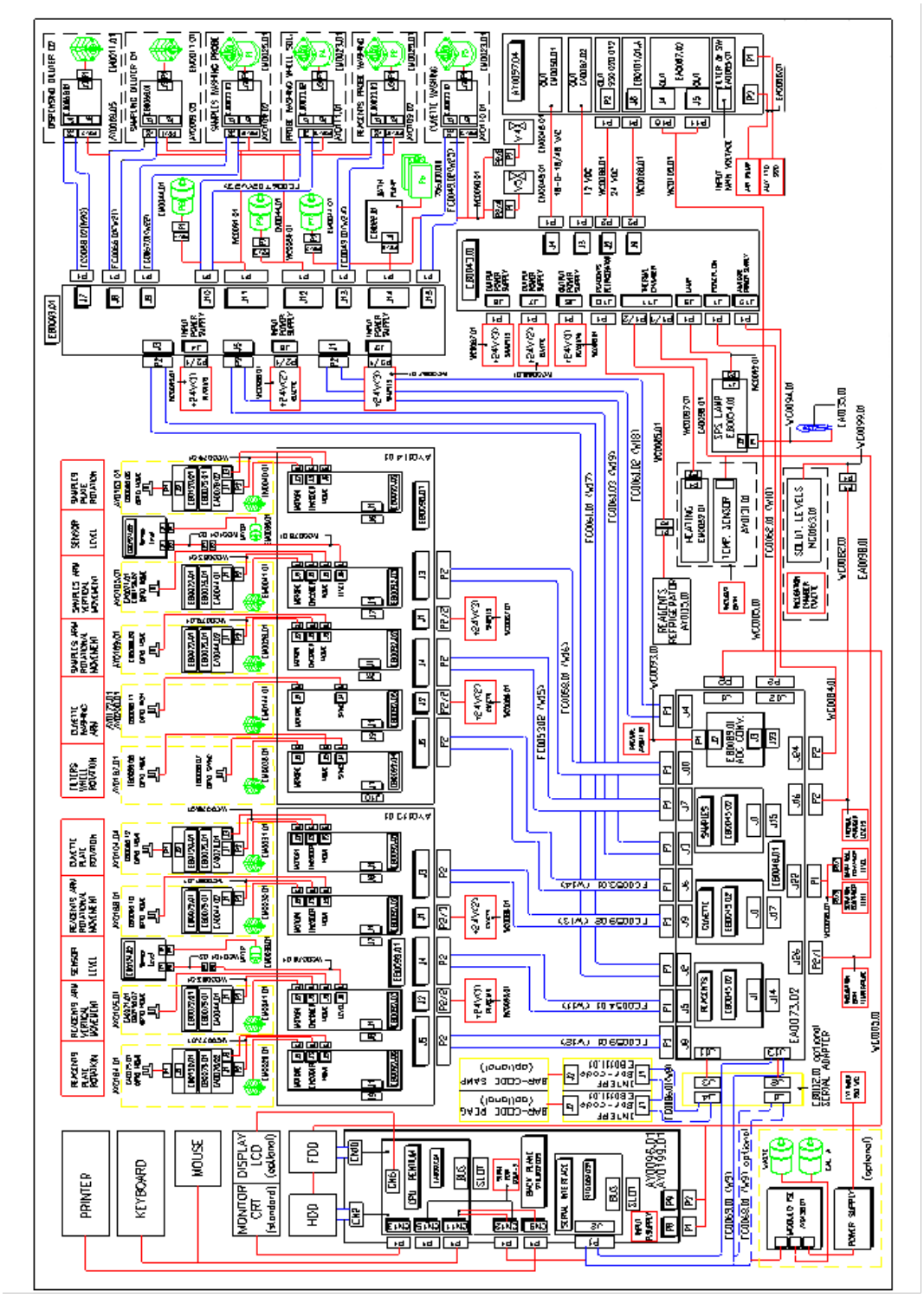
3.7.5 17970/27.A.PM (ASSEMBLY DRAWING)

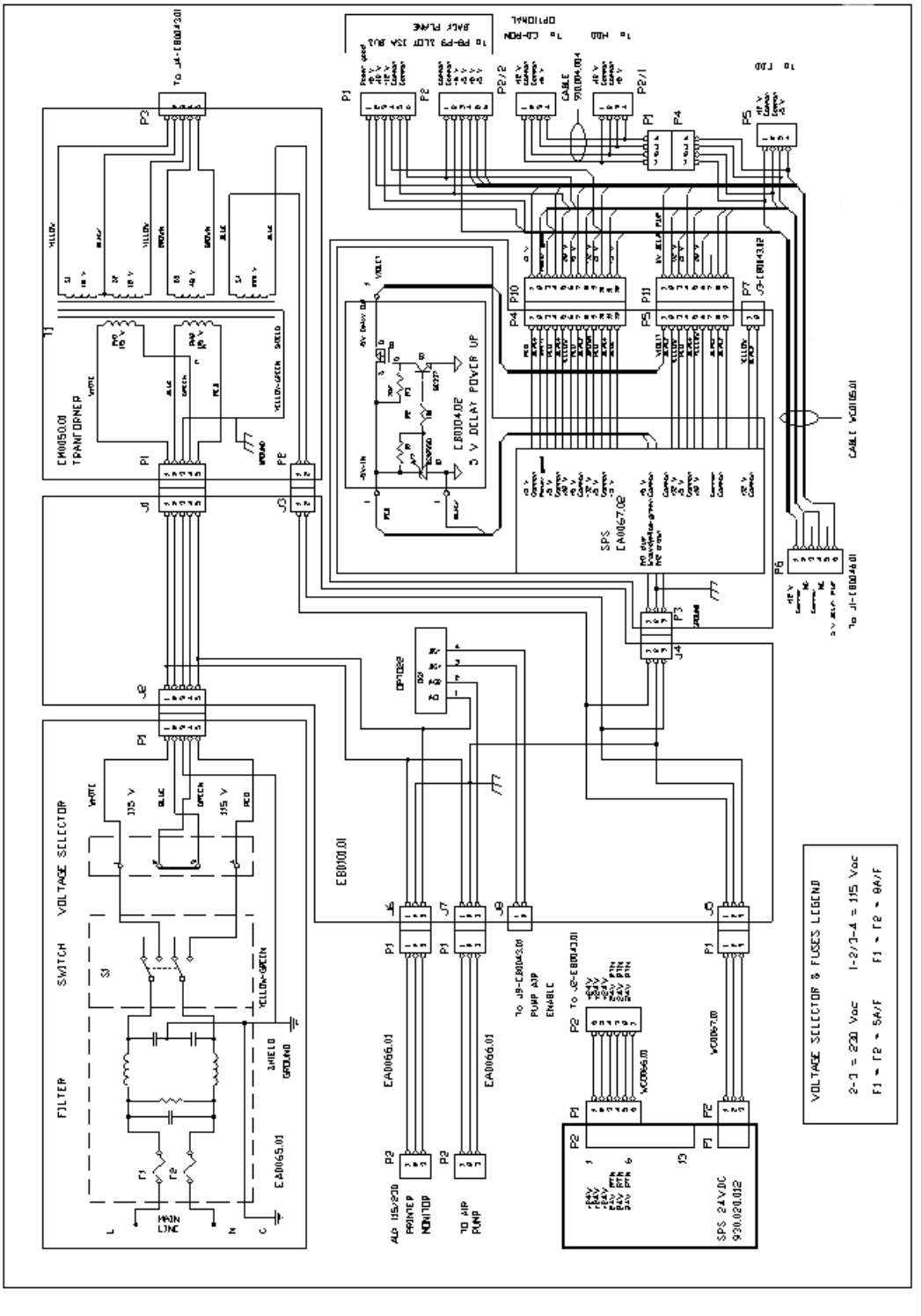
3.7.6 EM0050.01.B.SC (ELECTRICAL DIAGRAM)

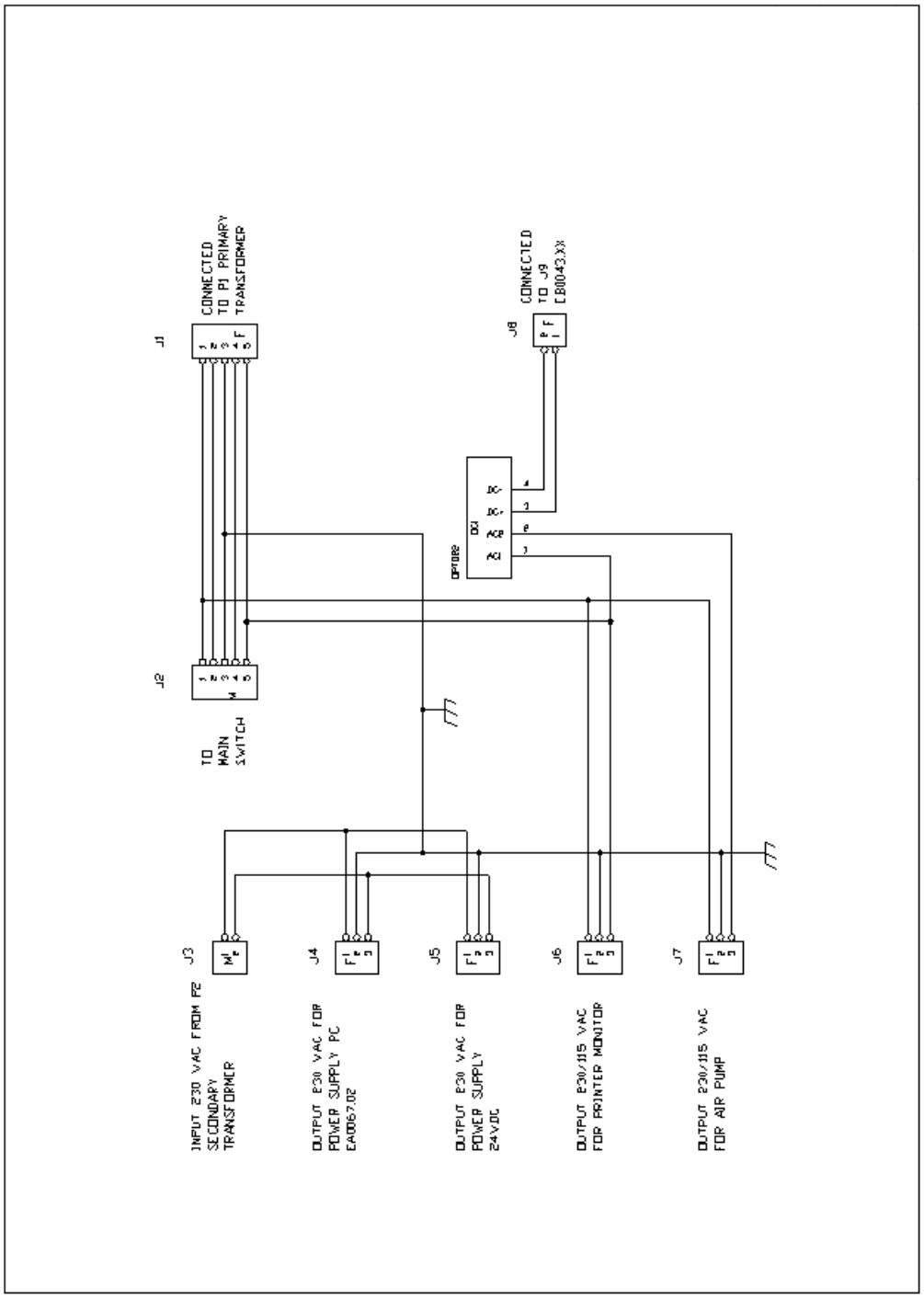
3.7.7 EA0067.02.0.SC (ELECTRICAL DIAGRAM)

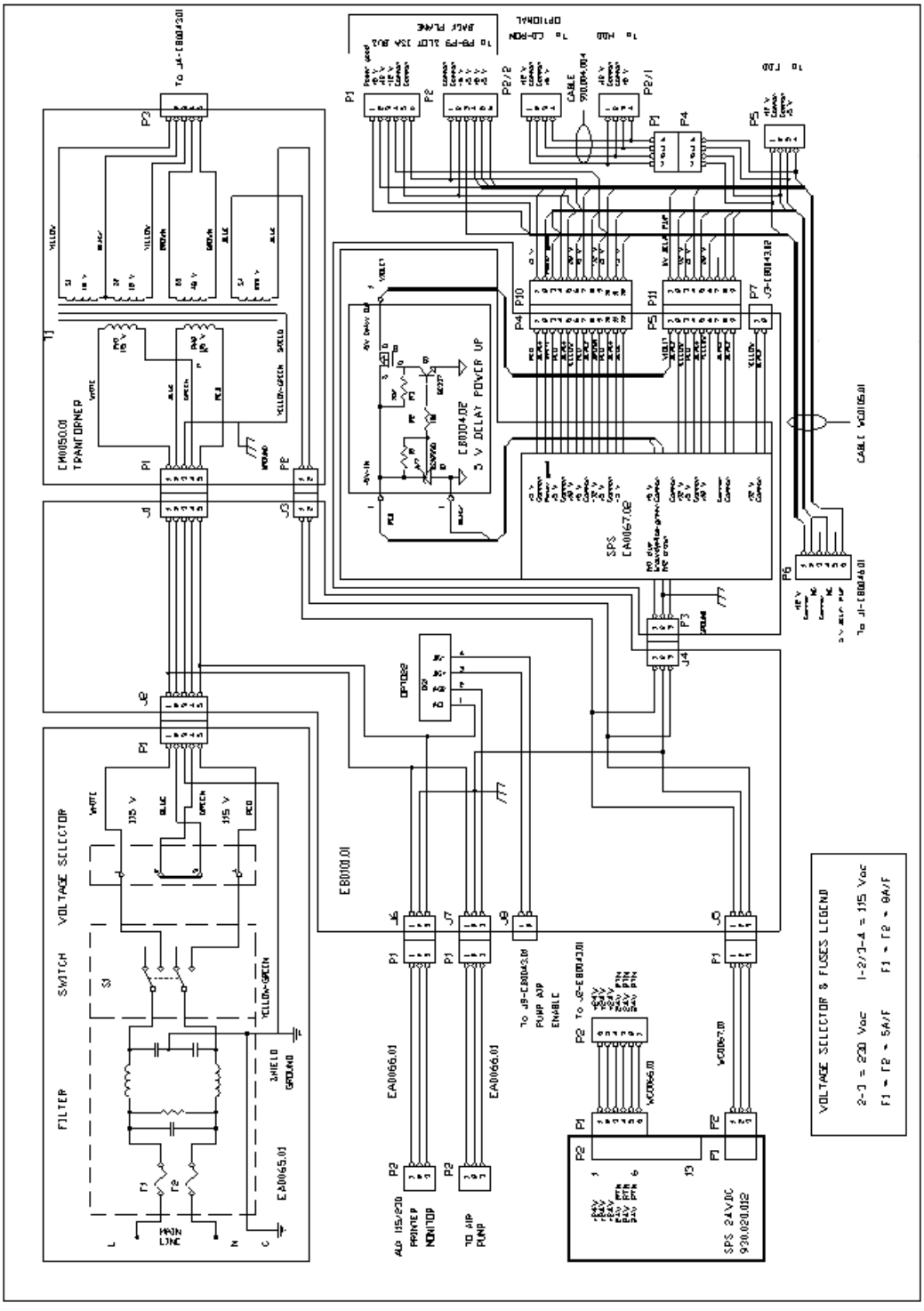
3.7.8 17970/7.A.SC (ELECTRICAL DIAGRAM)

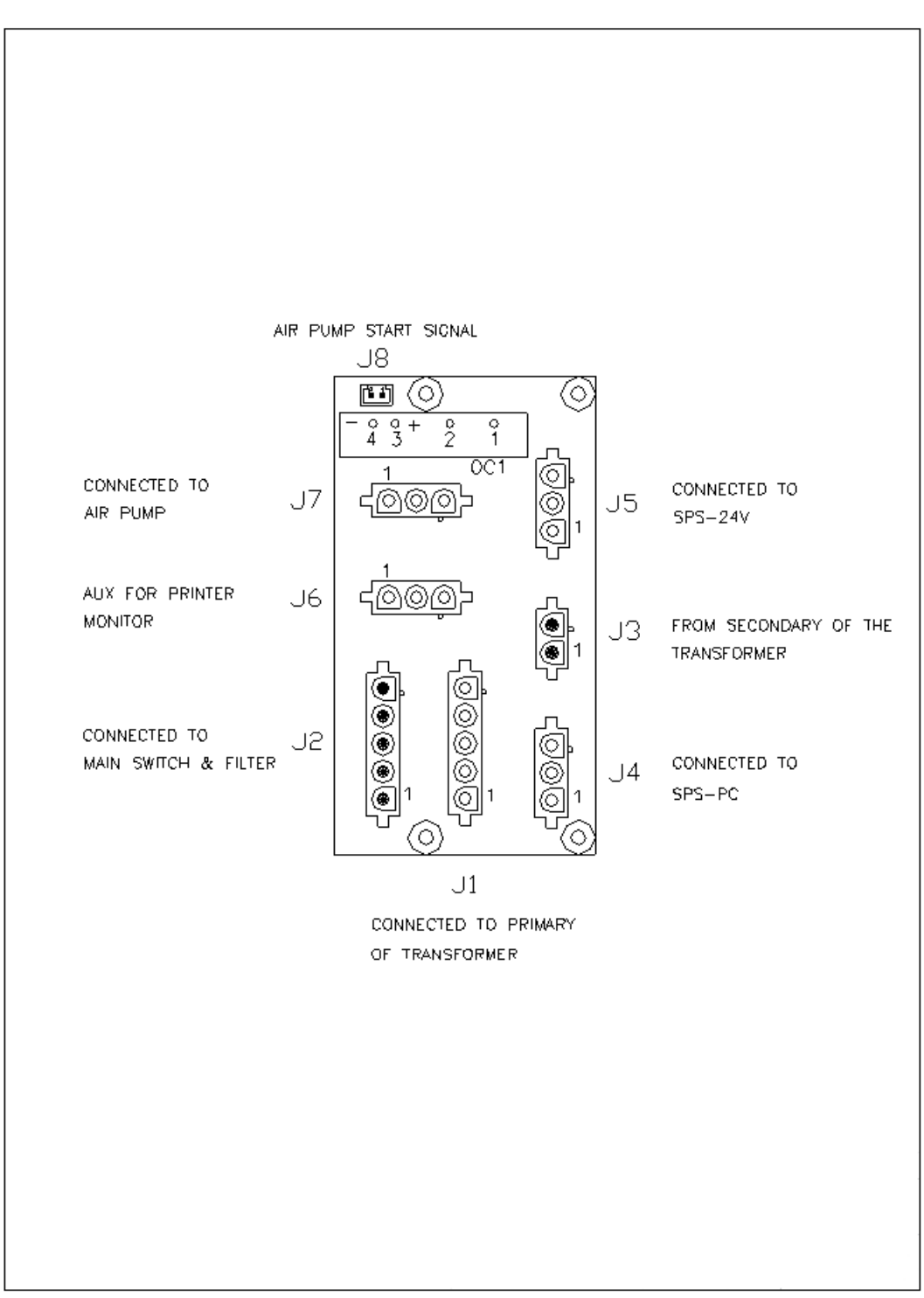
3.7.9 17970/7.B.PM (ASSEMBLY DRAWING)

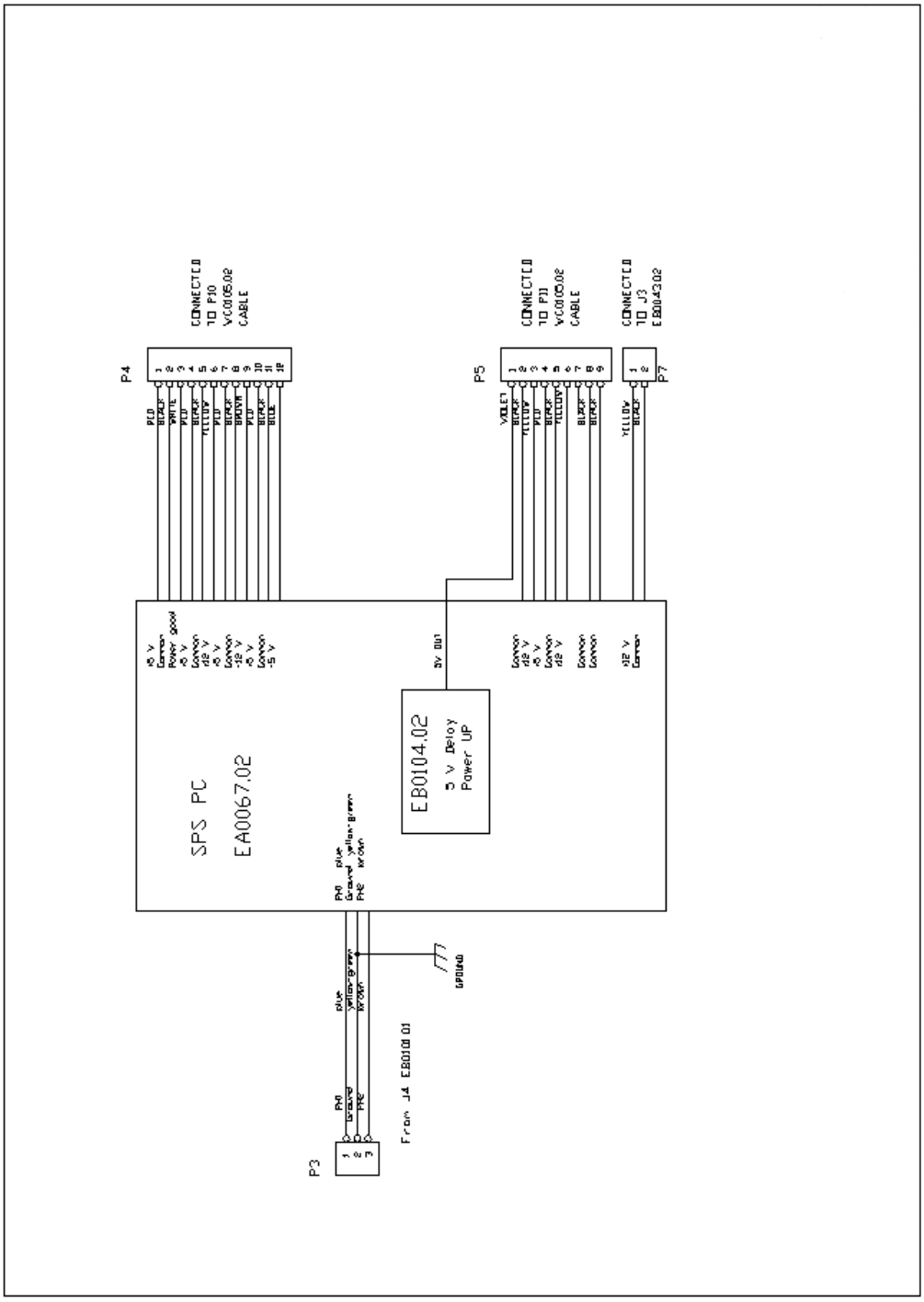

PRINTER
KEYBOARD
MOUSE
MONITOR DISPLAY LCD (standard)
CRT (standard)
FDD
HDD
(optional)

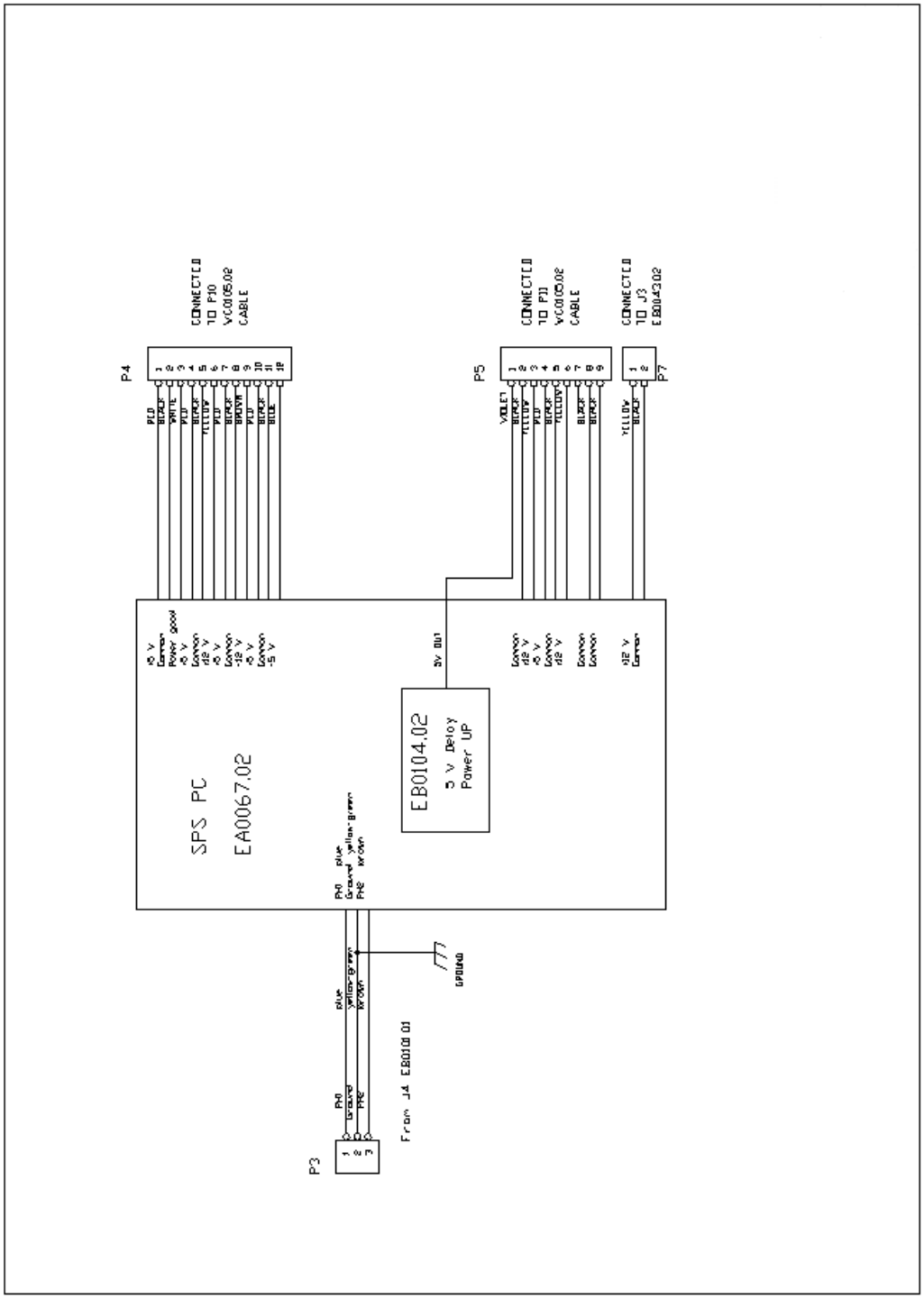

VOLTAGE SELECTOR & FUSES LEGEND
2-3 = 230 Vac 1-2/3-4 = 115 Vac
F1 - F2 - 5A/F F1 - F2 - 8A/F
SWITCH VOLTAGE SELECTOR
FILTER
EA0065.01
EA0066.01
EA0066.01
EA0067.00
EA0068.00
EA0067.01
EA0068.01
EA0065.01
EA0050.01
TRANSFORMER
EA0067.02
SPS
5 V DELAY POWER UP
EB0004.02E
EB0001.01
SPS 24V DC
930.020.012
MAIN LINE
PRINTER MONITOR
TO AIR PUMP
PUMP AIR ENABLE
CABLE
930.004.004
CABLE
930.005.01
SHIELD
GROUND
YELLOW-GREEN
WHITE
BLUE
GREEN
RED
BLACK
BROWN
YELLOW

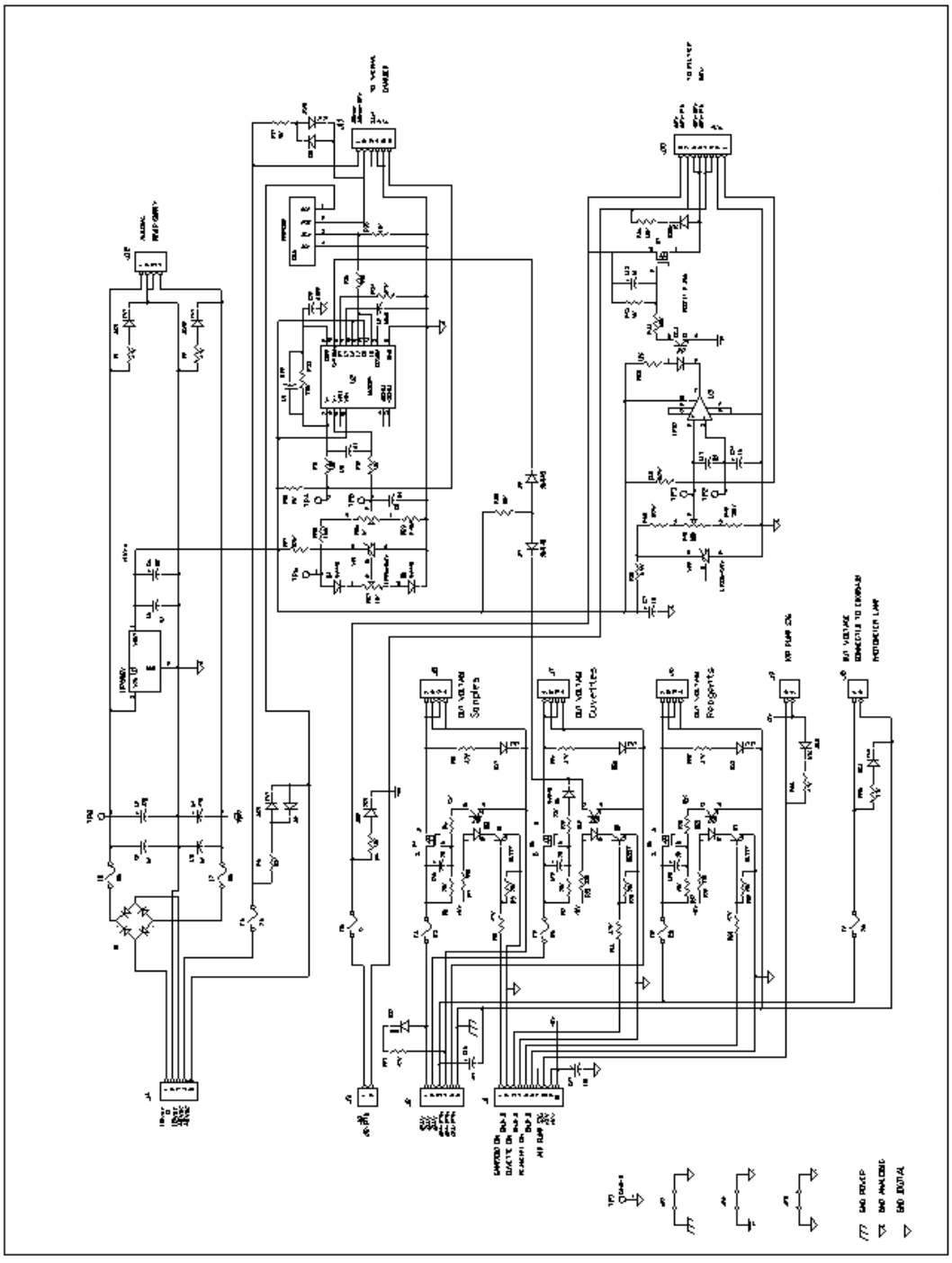

J1
CONNECTED
TO P1 PRIMARY
TRANSFORMER
J8
CONNECTED
TO J9
EB0043.XX
OPTO82
J2
TO
MAIN
SWITCH
J3
INPUT 230 VAC FROM P2
SECONDARY
TRANSFORMER
J4
OUTPUT 230 VAC FOR
POWER SUPPLY PC
EAD067.02
J5
OUTPUT 230 VAC FOR
POWER SUPPLY
24VDC
J6
OUTPUT 230/115 VAC
FOR PRINTER MONITOR
J7
OUTPUT 230/115 VAC
FOR AIR PUMP

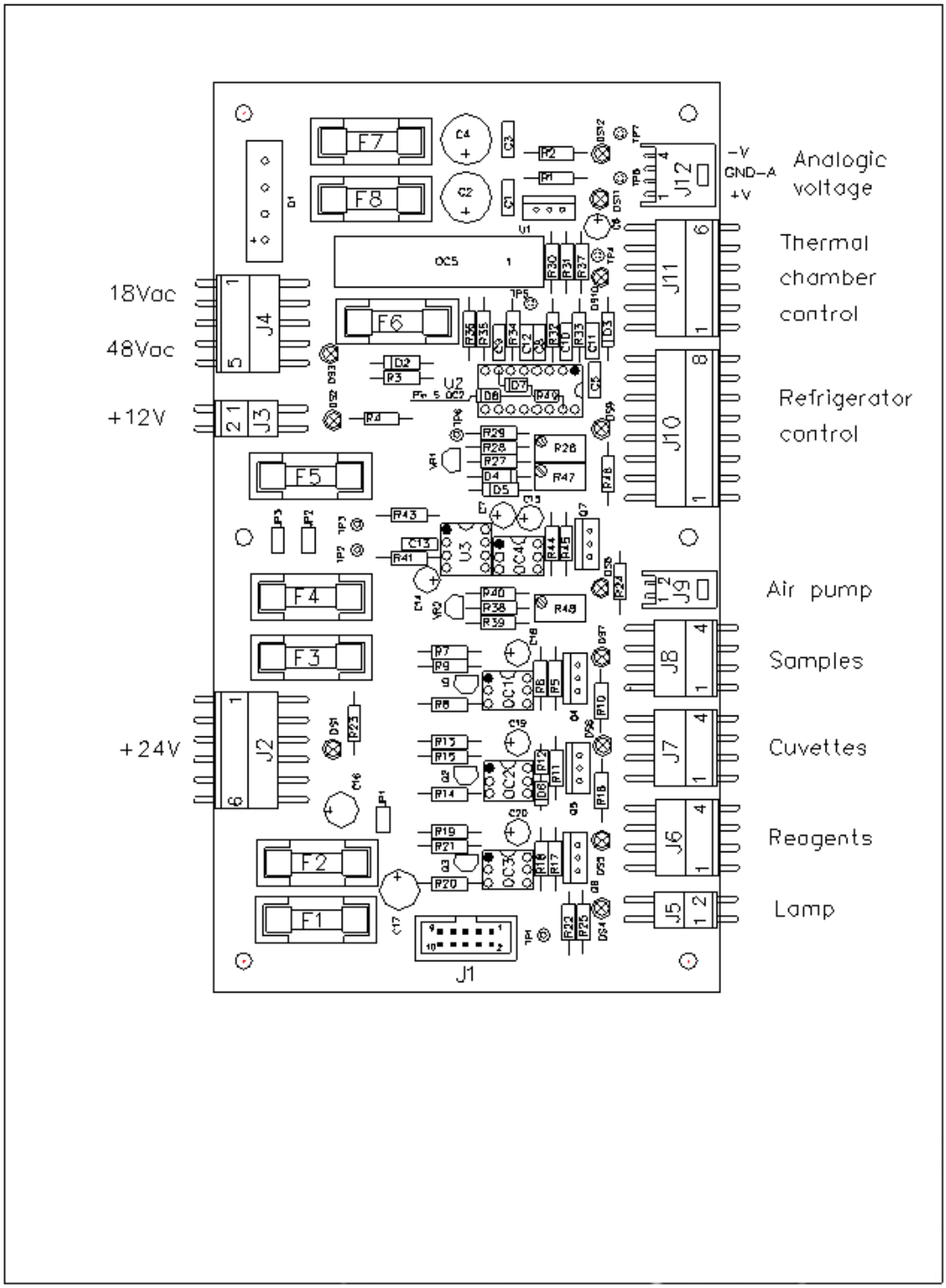

SWITCH VOLTAGE SELECTOR
FILTER
EA0065.01
EA0066.01
EA0066.01
EA0067.00
EA0067.01
EB0100.01
EB0104.02
5 V DELAY POWER UP
CM0050.01
TRANSFORMER
SPS 24 VDC
930.020.012
VOLTAGE SELECTOR & FUSES LEGEND
2-3 = 230 Vac 1-2/3-4 = 115 Vac
F1 - F2 - 5A/F F1 - F2 - 8A/F
MAIN LINE
PRINTER MONITOR
TO AIR PUMP
PUMP AIR ENABLE
CABLE
SPS
EA0067.02


AIR PUMP START SIGNAL
J8
– 4 3 + 2 1
OC1
CONNECTED TO
AIR PUMP
J7
1
J5
1
CONNECTED TO
SPS–24V
AUX FOR PRINTER
MONITOR
J6
1
J3
1
FROM SECONDARY OF THE
TRANSFORMER
CONNECTED TO
MAIN SWITCH & FILTER
J2
1
1
J4
1
CONNECTED TO
SPS–PC
J1
CONNECTED TO PRIMARY
OF TRANSFORMER


SPS PC
EA0067.02
EB0104.02
5 V Delay
Power UP
P3
P4
P5
P7
GROUND


SPS PC
EA0067.02
EB0104.02
5 V Delay
Power UP
P3
P4
P5
P7
CONNECTED
TO P10
VC0105.02
CABLE
CONNECTED
TO P11
VC0105.02
CABLE
CONNECTED
TO J3
EB0043.02
From J4 EB0101.01


Samples
Cuvettes
Reagents


18Vac
48Vac
+12V
+24V
J4
J3
J2
F7
F8
F6
F5
F4
F3
F2
F1
J1
J12
J11
J10
J9
J8
J7
J6
J5
-V
GND-A
+V
Analogic voltage
Thermal chamber control
Refrigerator control
Air pump
Samples
Cuvettes
Reagents
Lamp

4 INTERFACE PUMP - VALVES (P/N: 17970/24)

TECHNICAL DESCRIPTION

The present functions are devided into three sections.

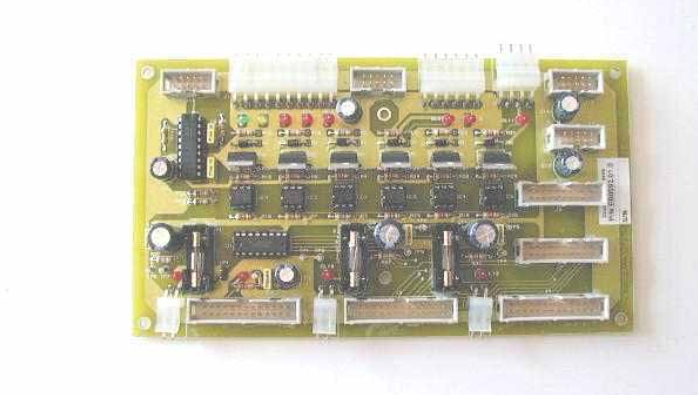


Diagram 17970/24.SC page 1 of 3 include:

- Control Valve V4 via U1, OC2 and Q2.
- Control valve V5 via U1, OC1 and Q1.
- Control pump P6 by means of signal E_P6C that enables the integrated circuit U2.
- Control pump P7 via U1, OC3 and Q3.
- Distribution of signal E_P5C to control pump P5 via board EB0033.01.
- Distribution of voltage of [+24 V] for pump P5.

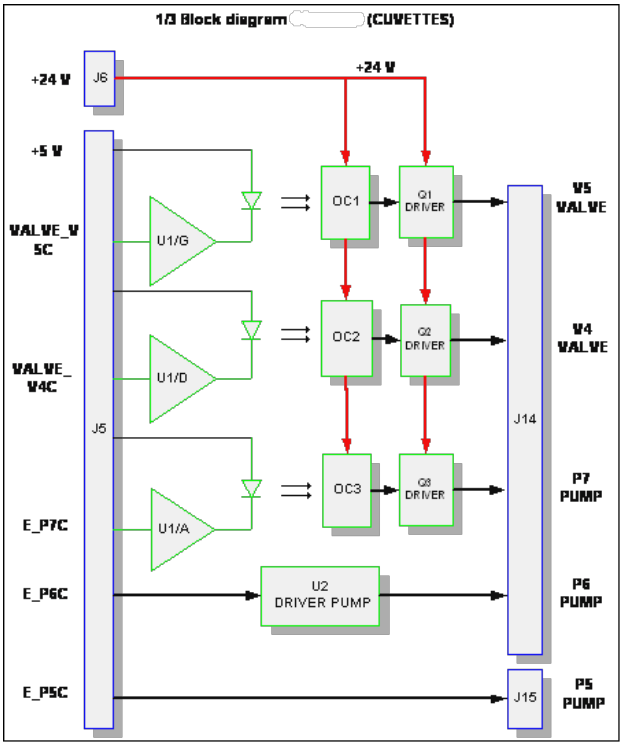


Diagram 17970/24.SC page 2 of 3 include:

- Distribution of signals (CK, LP, EN, CW-CCW, SYNC) to control diluter D1 via board **17970/11**.
- Distribution of signals (E_P1CA, LP, CK) to control pump P1 via board EB0033.03.
- Distribution of signal E_P4CA to control pump P4 via board EB0033.02.
- Control pump P8 via U1, OC6 and Q6.
- Distribution of voltage of [+24 V] for pumps P1, P4 and diluter D1.

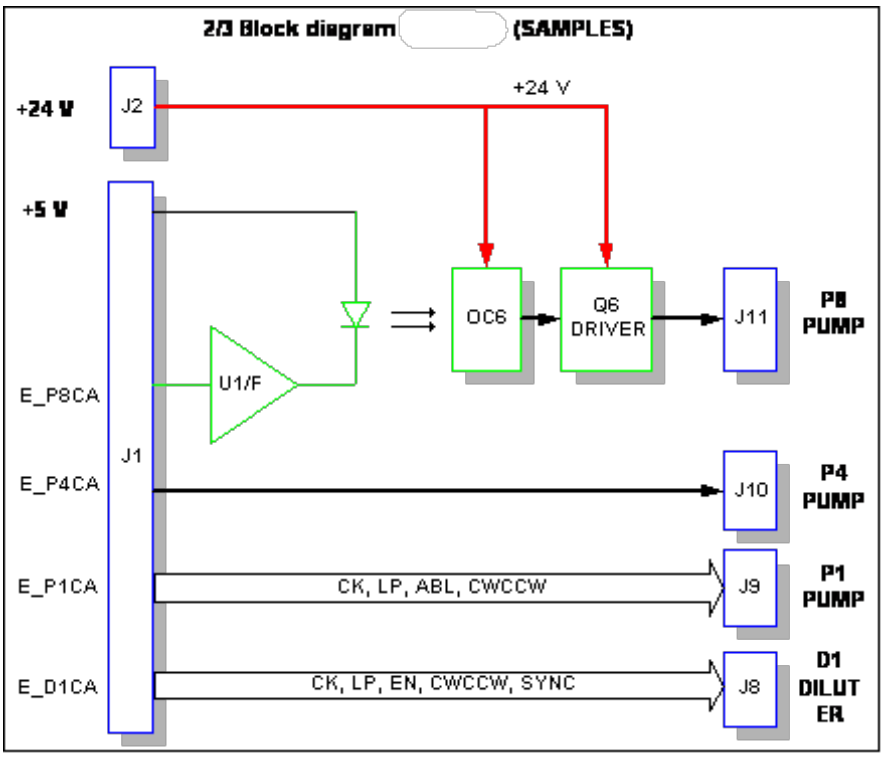
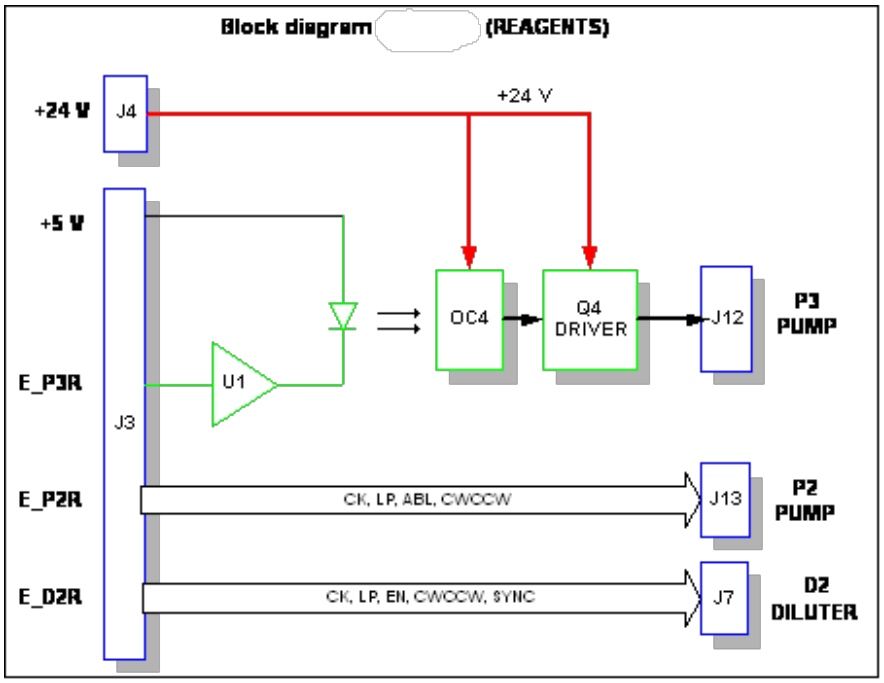


Diagram 17970/24.SC page 3 of 3 include:

- Distribution of signals (CK, LP, EN, CW-CCW, SYNC) to control diluter module D2 via board **17970/11**.
- Distribution of signals (E_P2R, LP, CK) to control pump P2 via board EB0033.03.
- Control of pump P3 via U1, OC4 and Q4.
- Distribution of voltage [+24 V] for pump P2 and Diluter D2.



JP1	Closed

TABLE 2
Setting jumpers

Documentation

17970/24.A.SC	(electric diagram pag. 1/3)
17970/24.A.SC	(electric diagram pag. 2/3)
17970/24.A.SC	(electric diagram pag. 3/3)
17970/24.A.PM	(assembly drawing)

4.1 Maintenance

Remove the outside panels: (see “General Maintenance“ section “To remove outside panels”).

Operations to be done with analyzer turned OFF.

4.1.1 TO REPLACE PUMP INTERFACE AND VALVES

1. Disconnect all connectors from the board.
2. Remove the four screws and take out the board.
3. Replace it, make sure not to invert the connectors. (see block diagram).

4.2 Trouble Shooting Guide

This section its a series of symptoms or problems and how to solve them.
To solve some of the problems use the Diagnostic Program “HUMASTAR 300 TOOLS“.

Defect	Causes and Remedies
Pump P2 does NOT start.	- Check the voltage PWR ON of the Reagent System (See also „3.5 Trouble Shooting Guide“.) - Check the voltage of +24V on J4 (DL10 ON) - Check Fuse F2 - Check fuse F1 on board EB0033.03 - Replace board EB0033.03 - Replace the CPU slave board **17970/8**
Pump P3 does NOT work	- Check the voltage of PWR ON of the Reagent System (See also „3.5 Trouble Shooting Guide“.) - Check voltage of +24V on J4 (DL10 ON) - Check fuse F2 - Check the if the LED DL8 is ON, if necessary replace board **17970/24** - Check the resistance of the motor, about 25 ohm, if necessary replace it. - Replace the CPU slave board – Reagents - **17970/8**
Pump P5 does NOT work.	- Check the start voltage PWR ON of the measuring cuvette system. (See also „3.5 Trouble Shooting Guide“.) - Check voltage +24V on J6 (DL2 ON) - Check fuse F1 - Check fuse F1 on board EB0033.01 - Replace board EB0033.01 - Replace the CPU slave board (cuvette system) **17970/8**
Pump P6 does NOT start	- Check the start voltage PWR ON of the measuring cuvette system. (See also „3.5 Trouble Shooting Guide“.) - Check voltage +24V on J6 (DL2 ON) - Check fuse F1 - Make sure that the LED is flashing on driver board EB0122.01 - Replace U2 - Replace the CPU slave board **17970/8**

Pump P7 does NOT start	- Check the start voltage PWR ON of the measuring cuvette system. (See also „3.5 Trouble Shooting Guide“.) - Check voltage +24V on J6 (DL2 ON) - Check fuse F1 - Check the resistance of the motor, should be about 25 ohm, if necessary replace. - Make sure that LED DL7 is ON, if necessary replace board **17970/24** - Replace the CPU slave board **17970/8**
Pump P8 does NOT start	- Check the start voltage PWR ON of the Sampling system. (See also „3.5 Trouble Shooting Guide“.) - Check voltage +24V on J2 (DL12 ON) - Check fuse F3 - Check the resistance of the motor, should be about 25 ohm, if necessary replace - Make sure that led DL11 is ON, if necessary replace board **17970/24** - Replace the CPU slave board of Sampling System **17970/8**
Valves V4 and V5 do not start	- Check the start up voltage PWR ON of the Cuvette system (See also „3.5 Trouble Shooting Guide“.) - Check the voltage +24V on J6 (DL2 ON) - Check fuse F1 - On V5 check the resistance of its coil, should be about 125 ohm, replace if necessary - On V4 check the resistance of its coil, should be about 125 ohm, replace if necessary - Make sure that led DL3 / DL4 are ON, if necessary replace board **17970/24** - Replace the CPU slave board of Cuvette System **17970/8**
Diluter D1 does NOT work	- Check the start up voltage PWR ON of the Sampling System. (See also „3.5 Trouble Shooting Guide“.) - Check voltage +24V on J2 (DL12 ON) - Check fuse F3 - Replace board 17970/11 - Replace the CPU slave board Sampling System **17970/8**.

	- Check the start up voltage PWR ON of the Reagent System (See also „3.5 Trouble Shooting Guide“.)
Diluter D2 does NOT work	- Check voltage +24V on J4 (DL10 ON) - Check fuse F2 - Replace board **17970/11** - Replace CPU slave board Reagent System **17970/8**

4.3 Spare Part List

! To assure an efficient and fast technical service, HUMAN suggests to keep in stock the parts indicated with (•). When ordering make sure to give the following information: Code Number, Description and Quantity.

Code	Sub_Code	Description	QTY
17970/24		• Pump and valve driver interface	1
	680.010.225	• Fuse 2,5A	3

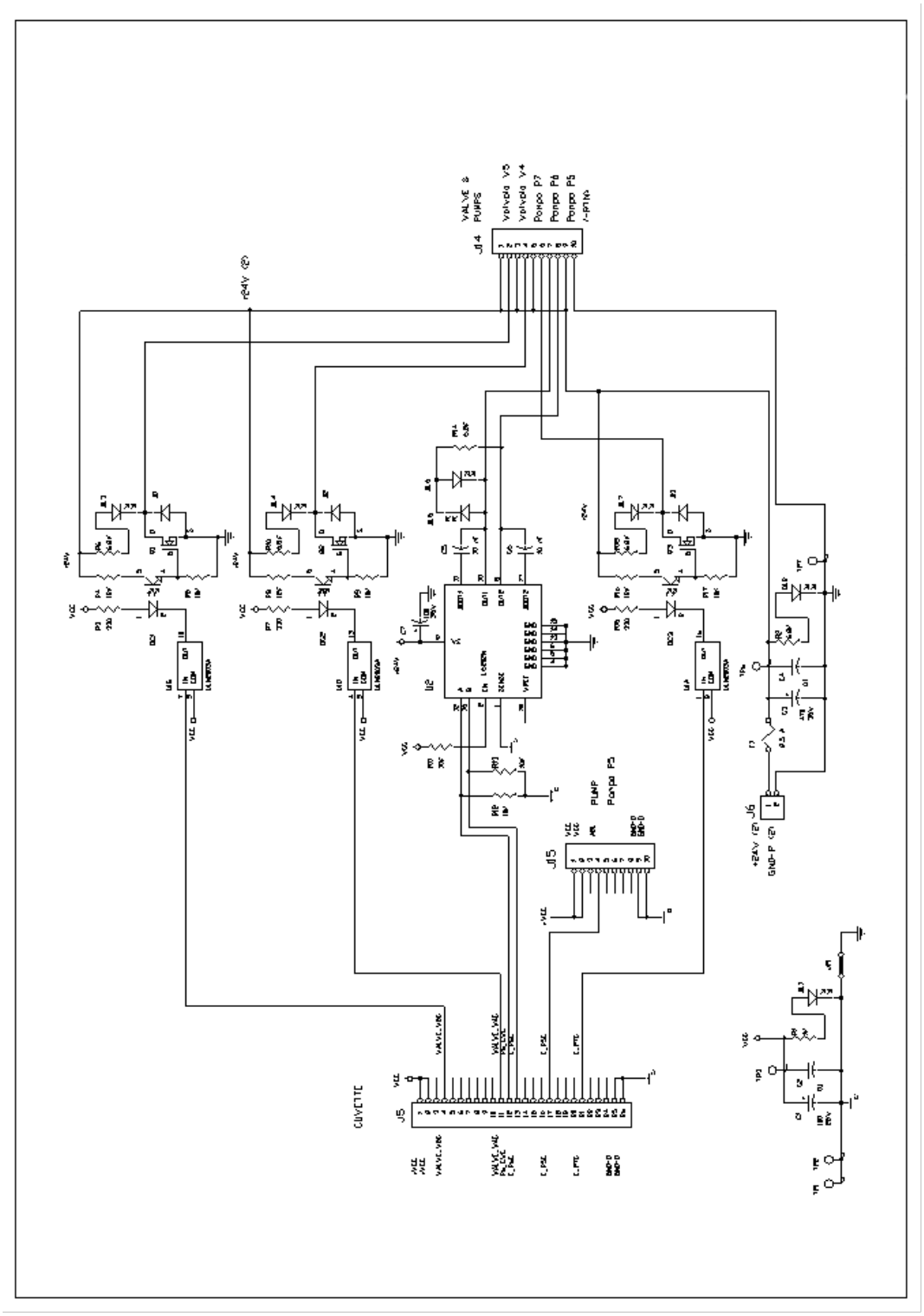
4.4 Enclosed Documentation

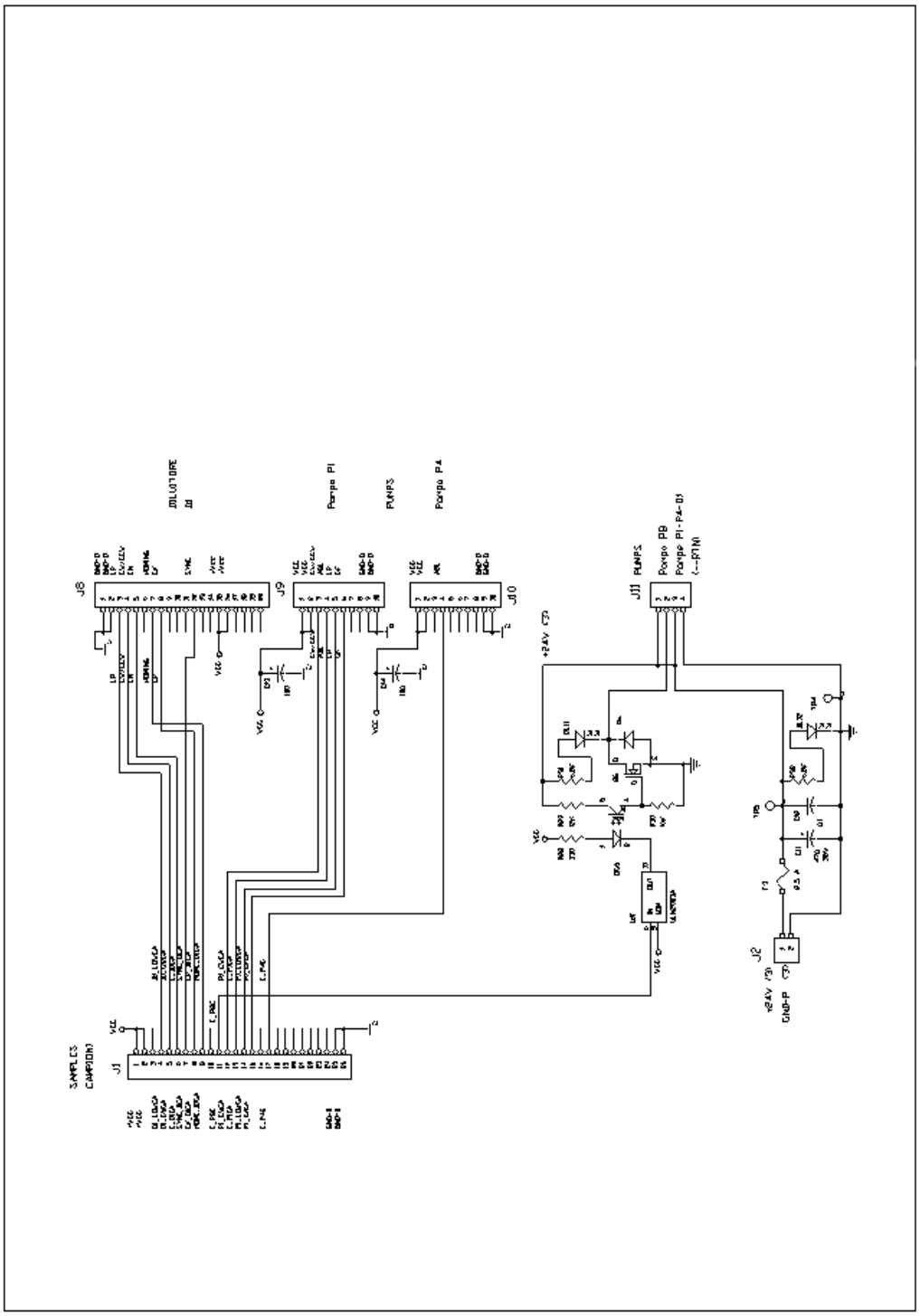
4.4.1 17970/24.A.SC (ELECTRIC DIAGRAM PAG. 1/3)

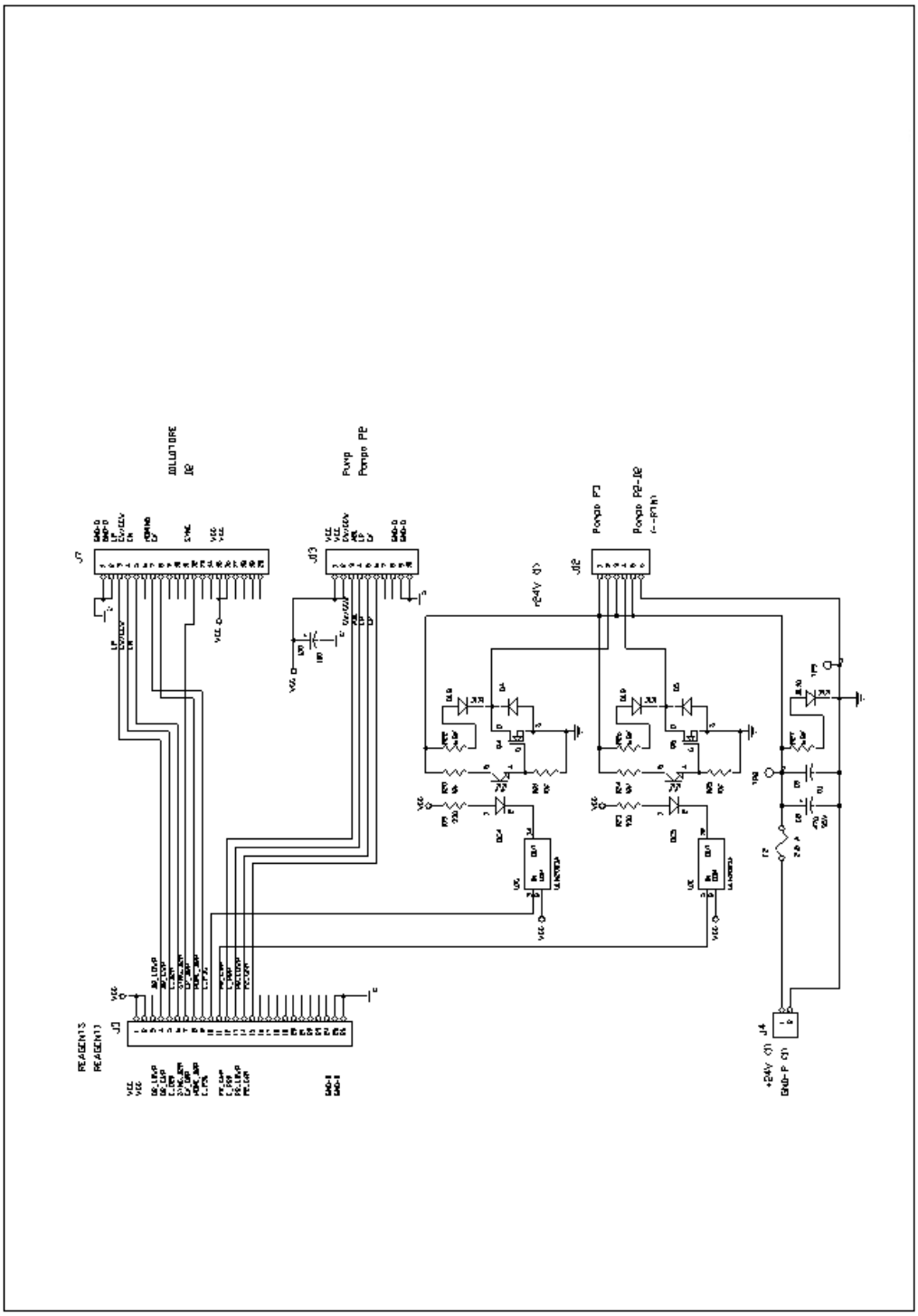
4.4.2 17970/24.A.SC (ELECTRIC DIAGRAM PAG. 2/3)

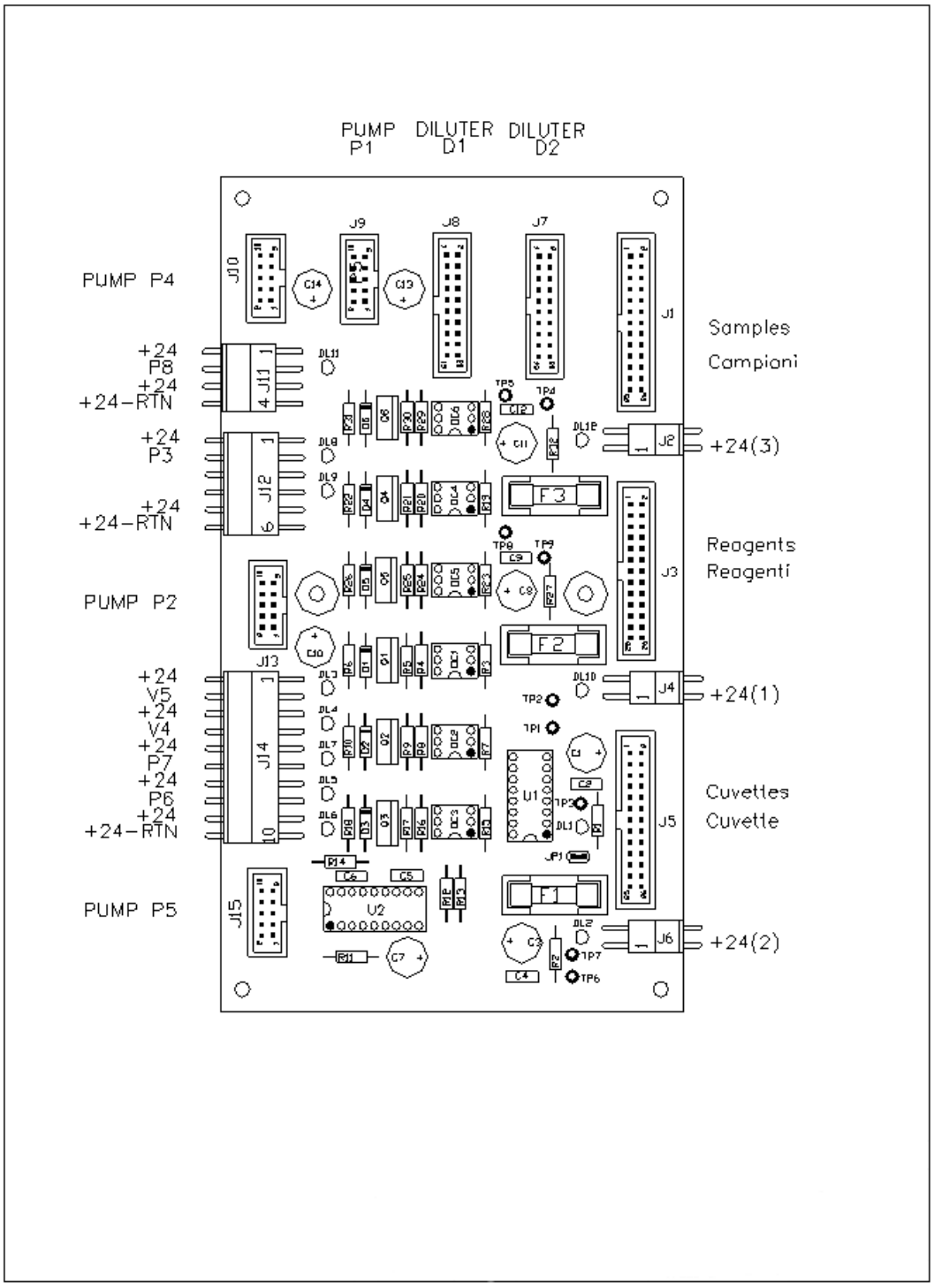
4.4.3 17970/24.A.SC (ELECTRIC DIAGRAM PAG. 3/3)

4.4.4 17970/24.A.PM (ASSEMBLY DRAWING)







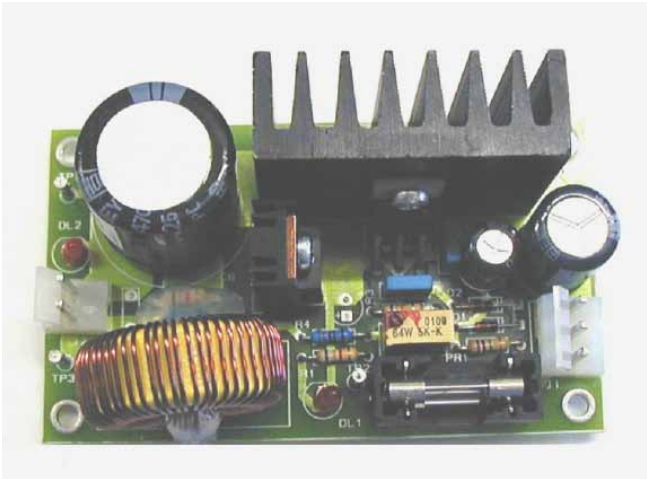

PUMP P1
DILUTER D1
DILUTER D2
PUMP P4
+24 P8
+24 +24-RTN
+24 P3
+24 +24-RTN
PUMP P2
+24 V5
+24 V4
+24 P7
+24 P6
+24 +24-RTN
PUMP P5
Samples Campioni
+24(3)
Reagents Reagenti
+24(1)
Cuvettes Cuvette
+24(2)
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
J11
J12
J13
J14
J15
F1
F2
F3
U1
U2

5 POWER SUPPLY PHOTOMETER LAMP (P/N: 17970/10)

Technical Description

The function of this board is to generate a stabilized voltage of +11V for the Photometer lamp.

The output voltage can be adjusted with PR1.



Item	Test point	Range
1	TP2	Input voltage from +23,5V to +24,5V
2	TP3	From +10,5 to +11,5 Adj. PR1

TABLE 3
Nominal Voltages

All voltage are referred to GND = TP1

Documentation

17970/10.A.SC (electrical diagram)
17970/10.A.PM (assembly drawing)

5.1 Trouble Shooting Guide

This section lists a series of Symptoms or Problems and how to solve them.
To solve some of the problems use the Diagnostic Program "HumaStar 300 TOOLS ".

Defects	Causes and Remedies
The Lamp does NOT turn ON	- Check if the lamp is interrupted - Check if the led DL2 is lighted - Check fuse F1 - Check if the led DL1 is lighted - Check fuse F1 on board **17970/7** - Check the +24V on J1 on **17970/7** - Check the +24V on J1 on the board - Change power supply board 24V **17956/1** - Change power supply board **17970/10**
The voltage of the lamp is not as specified	- Lamp is about to burn out. Change lamp. - Check the +24V on J1 on the board - Change **17970/10** board.
The light of intensity does NOT stable	- Lamp is about to burn out. Change Lamp. - Bad connection on the connector. - Check the voltage stability and ripple noise - Input voltage is out of specs +24V on J1 of the board - Change power supply board +24V **17956/1** - Change board **17970/10**
Lamp burns the minute it is connected to the board.	- Check the +11V on J2 on the board - Change **17970/10** board.

5.2 Spare Part List

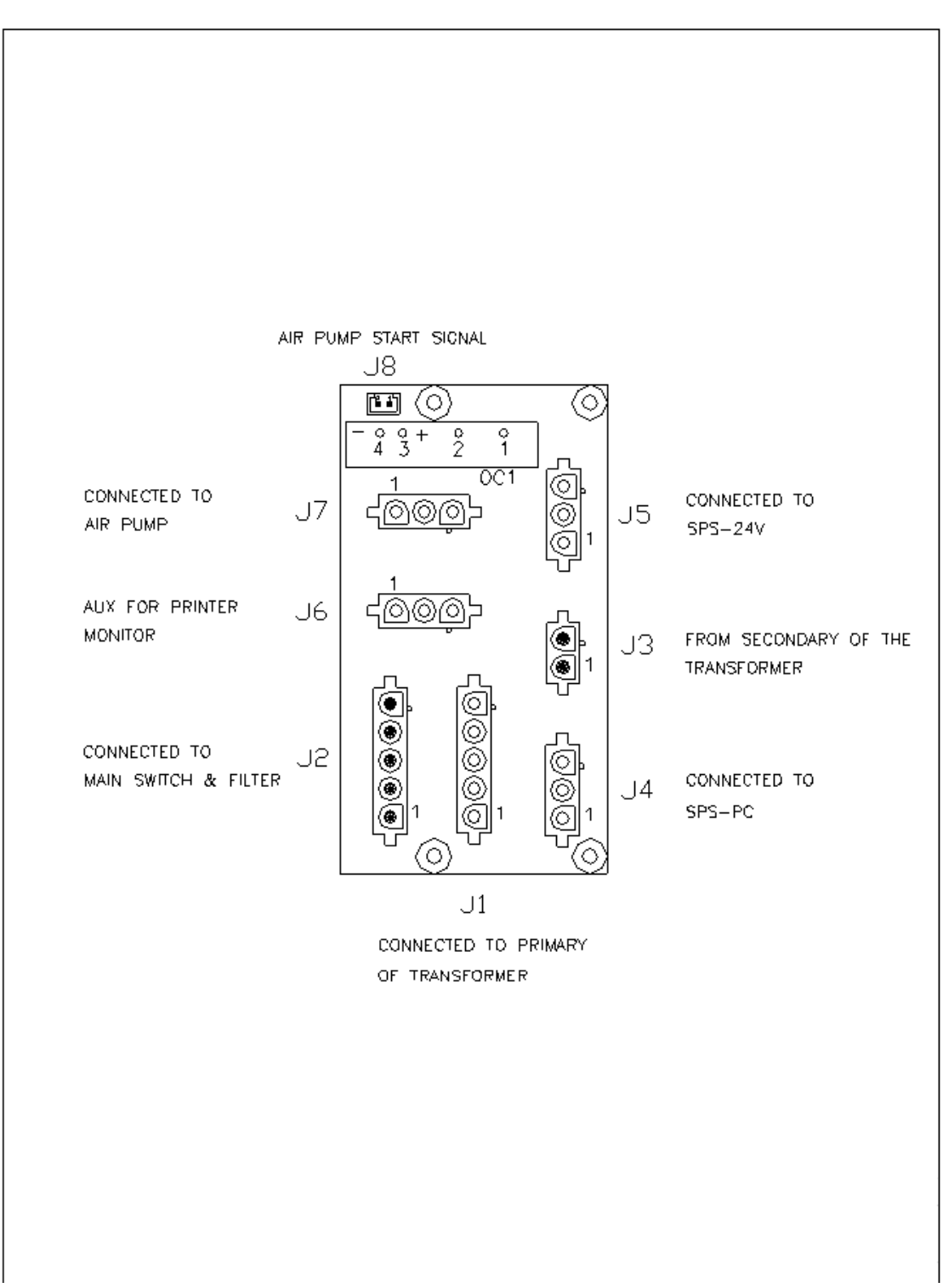
! To assure a rapid and efficient technical service to its clients HUMAN suggests to keep in stock all the parts marked with this symbol (•). The order request has to be done with the following information: Part Number or Code, Description and Quantity.

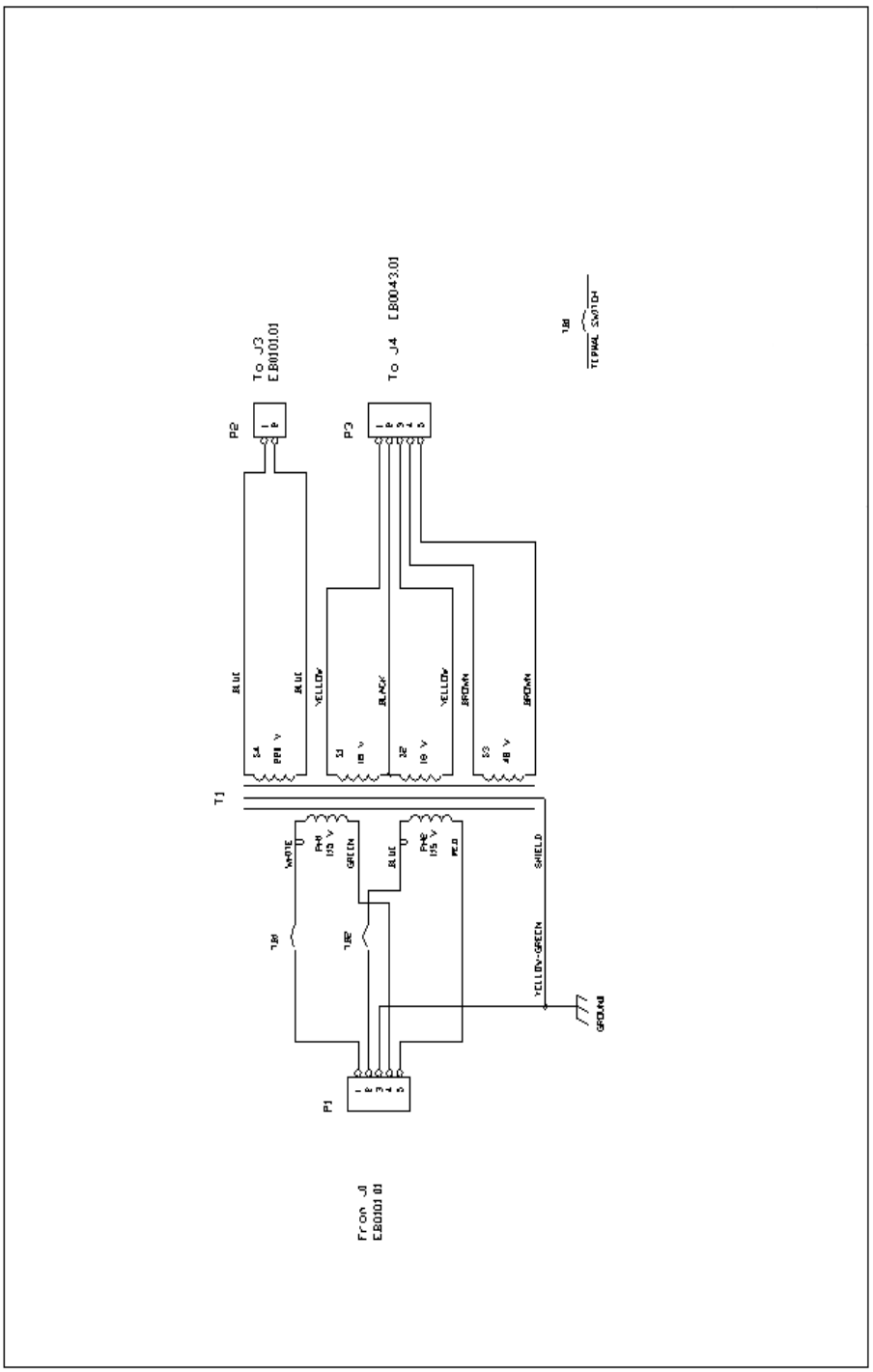
Code	Sub_Code		Description	QTY
17970/10		•	Power supply lamp board	1
	680.010.216	•	Fuses 1,6A	1

5.3 Enclosed Documentation

5.3.1 17970/10.A.SC (ELECTRICAL DIAGRAM)

5.3.2 17970/10.A.PM (ASSEMBLY DRAWING)

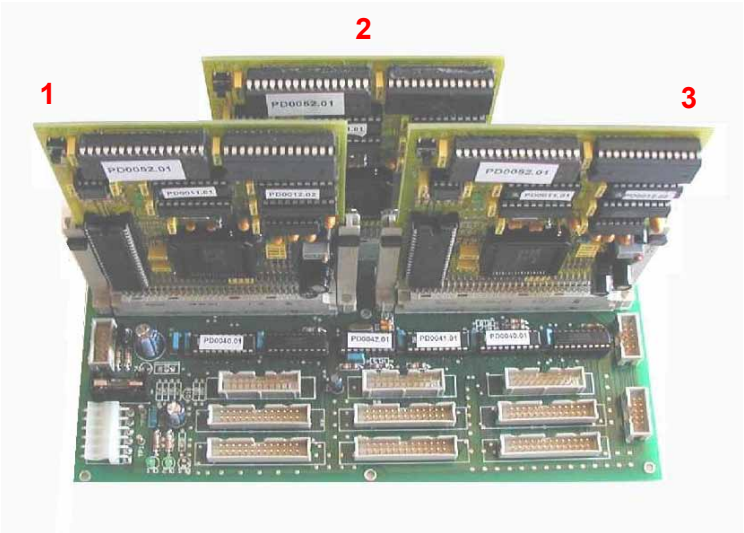

AIR PUMP START SIGNAL
J8
– 4 3 + 2 1
OC1
CONNECTED TO
AIR PUMP
J7
1
J5
CONNECTED TO
SPS–24V
AUX FOR PRINTER
MONITOR
J6
J3
FROM SECONDARY OF THE
TRANSFORMER
CONNECTED TO
MAIN SWITCH & FILTER
J2
J4
CONNECTED TO
SPS–PC
J1
CONNECTED TO PRIMARY
OF TRANSFORMER


To J3
EB0101.01
To J4 EB0043.01
P2
P3
P1
T1
BLUE
YELLOW
BLACK
BROWN
WHITE
GREEN
SHIELD
YELLOW-GREEN
TERMINAL SWITCH
GROUND
From J1
EB0101.01

6 MICROPROCESSOR ASSEMBLY (P/N: EA0073.02)

TECHNICAL DESCRIPTION

The system consists of a PC (MASTER) and three µprocessors (SLAVES).



SLAVE (1) controls the complete robotics of the Reagent System such as:

- Rotation of the Reagent plate
- Movement of the Arm with its Reagent Probe.
- Reagent Diluter and its pump

SLAVE (2) controls the whole Analytical System (cuvette system), such as:

- Rotation of the measuring cuvette plate
- Rotation of the photometer filter revolver.
- Operation of the cuvette washing Arm.
- Pump and valve.

SLAVE (3) controls the complete robotics of the Sampling System, such as:

- Sample plate rotation.
- Movement of the Sampling Arm and its Probe.
- Sample Diluter and pump

The board **17970/9** (mother board) holds also the A/D converter board (**17970/19**).

6.1 CPU Slave (P/N:17970/8)

TECHNICAL DESCRIPTION

The structure of this board is shown in block diagram EB0045.XX and its electrical diagram EB0045.00.B.SC.

- The processor unit (U1) consists of a microcontroller U1, a memory RAM (U3) and a programmed memory (U2) including a bidirectional I/O port.
- The serial transmission unit RS-232 (U10) is used to Transmit/Receive data bi-directionally to the PC master.
- Interface I/O PIO (U8) controls the input-output signals to the peripheries of servo-mechanisms, positioning sensors, pumps, etc.

! The 3 CPU slaves, 17970/8 are interchangeable (*). (*) In replacing the CPU slave (2) reading, check the correct value of temperature displayed on the monitor, see section "General Maintenance", to Temperature control.

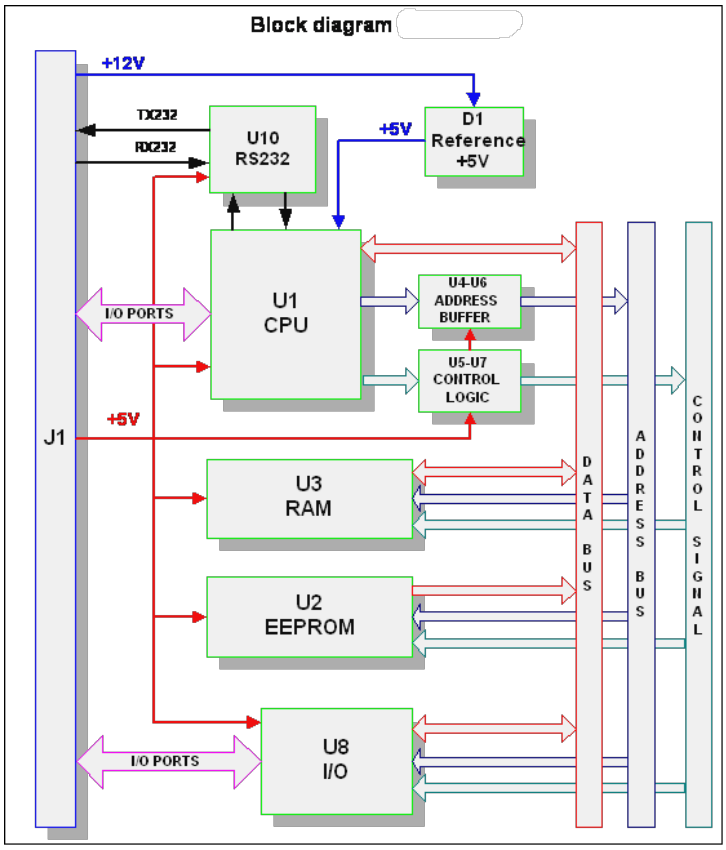


TABLE 4

Nominal voltages

Item	Test point	Ranges
1	TP2	From + 4,75V to + 5,25V
2	TP4	From +11,0V to +12,5V
3	TP6	From +4,90V to + 5,10V Reg. PR1

All voltages are referred to GND-A = GND-D = TP2 = TP3 (with JP1 closed)

JP1	closed
JP2	open

TABLE 5
Settings jumpers

Board	Description	Device	Layout Ref.	Software P/N
17970/8	CPU	EPROM 27C2001 EEPROM 256 K	U2	PD0052.01
17970/8	CPU	GAL16V8	U5	PD0011.01
17970/8	CPU	GAL16V8	U7	PD0012.02

TABLE 6
List of programmable devices

DOCUMENTATION

EB0045.00.B.SC (electrical diagram)
17970/8.A.PM (assembly drawing)

The Tables below lists the signals of the three CPU **slaves**.

Table signals CPU Reagent System

Item	Terminal J1	Label U1-U8	Signal Label	Description
1	1A	+5V		Power Supply 5v
2	1C	+5V		Power supply 5v
3	2A	GND		Digital ground
4	2C	GND		Digital ground
5	3A	+12V		Power supply 12v
6	3C	AGND		Analogical ground
7	4C	P30	TX232R	Data transmit line
8	4A	P31	RX232R	Data receive Line
9	5C	P70		
10	5A	P71		
11	6C	P72		
12	6A	P73		
13	7C	P74		
14	7A	P75		
15	8C	P76		
16	8A	P77		
17	9C	P21	HOME_DR	Flag Home Diluter D2 Reagents
18	9A	P22		

19	10C	P23	SENSOR_LR	Signal Sensor Reagent Level
20	10A	P24	HOME_PRR	Flag Home Reagent Probe
21	11C	P25	HOME_PIR	Flag Home Reagent Plate
22	11A	P26	HOME_BRR	Flag Home Reagent Arm
23	12C	P27	SYNC_DR	Flag Sync Diluter D2 Reagents
24	12A	P32	SYNC_0	
25	13C	P33	SYNC_1	
26	13A	P34	SYNC_2	
27	14C	P80	A_CLKR	Signal Clock
28	14A	P81	B_CLKR	Signal Clock
29	15C	P82	E_P4R	Enable Start Pump P4
30	15A	P83		
31	16C	P84	ONC_R	Start Air Pump
32	16A	P85	PR_CWR	Direction Reagent Probe
33	17C	P00	D_CWR	Direction Diluter D2 – Reagents
34	17A	P01		
35	18C	P02	BR_CWR	Direction Reagent Arm
36	18A	P03	PI_CWR	Direction Reagent Plate
37	19C	P04	E_PRR	Start Up/Down Reagent Probe
38	19A	P05	PWR_ONR	+24/Vcc On/Off Reagent System
39	20C	P06	I2CSDAR	Serial Data Line
40	20A	P07	I2CSCLR	Serial Clock line
41	21C	P92		
42	21A	PA0		
43	22C	PA1		
44	22A	PA2		
45	23C	PA3		
46	23A	PA4		
47	24C	PA5		
48	24A	PA6		
49	25C	PA7		
50	25A	PB0	E_DR	Start Diluter D2 Reagents
51	26C	PB1	E_P2R	Start Pump P2

52	26A	PB2	E_BRR	Start Reagent Arm
53	27C	PB3	E_PIR	Start Reagent Plate
54	27A	PB4	D_LOWR	Low power Motor Diluter D2
55	28C	PB5	P2_LOWR	Low power Motor Pump P2
56	28A	PB6	BR_LOWR	Low power Motor Reagent Arm
57	29C	PB7	PI_LOWR	Low power Motor Reagent Plate
58	29A	PC0		
59	30C	PC1		
60	30A	PC2		
61	31C	PC3	PR_LOWR	Low power motor Reagent Probe
62	31A	PC5		
63	32C	PC6		
64	32A	PC7	E_MIXERR	Start Mixer
		P20		
		P90		
		P91		
		P93		
		PC4	BEEPER	Acoustic signal

Table signals CPU Measurement System

Item	Terminal J1	Label U1-U8	Signal Label	Description
1	1A	+5V		Power supply 5v
2	1C	+5V		Power Supply 5v
3	2A	GND		Digital Ground
4	2C	GND		Digital Ground
5	3A	+12V		Power supply 12v
6	3C	AGND		Analogical Ground
7	4C	P30	TX232C	Data transmit Line
8	4A	P31	RX232C	Data receive Line
9	5C	P70	SENSOR_S1C	Flag [**Awash**] Minimum Liquid Level in container supplying liquid to the Incubation Bath.
10	5A	P71	BUSY_F	Busy Microprocessor Photometer Line

11	6C	P72	SENSOR_S3C	Flag [**Wash**] Minimum Liquid Level inside Wash So-lution Container
12	6A	P73	SENSOR_S4C	Flag [**Tb High**] Maxi-mum Liquid Level inside Incu-bation chamber
13	7C	P74		
14	7A	P75	SENSOR_S5C	Flag [**Tb Low**] Minimum Liquid Level inside Incu-bation chamber
15	8C	P76	TEMP_BTC	Temperature Incubation chamber
16	8A	P77		
17	9C	P21	C_BUSY	Busy line A/D converter
18	9A	P22	HOME_PRHIC	Flag Position **High** Cu-vette Washing Arm
19	10C	P23	START	Start A/D conversion
20	10A	P24		
21	11C	P25	HOME_PIC	Flag **Home** Cuvette Plate
22	11A	P26	HOME_PRLOC	Flag Position **Low** Cuvette Washing Arm (Not used)
23	12C	P27		
24	12A	P32	SYNC_0	
25	13C	P33	SYNC_1	
26	13A	P34	SYNC_2	
27	14C	P80		
28	14A	P81	B_CLKC	Clock Signal
29	15C	P82	VALVE_V5C	Start Valve V5
30	15A	P83	E_P6C	Enable Start Pump P6
31	16C	P84		
32	16A	P85		
33	17C	P00		
34	17A	P01	PR_CWC	Direction of Cuvette Washing Arm
35	18C	P02		
36	18A	P03	PI_CWC	Direction of Reaction cuvette plate
37	19C	P04		
38	19A	P05	PWR_ONC	+24/Vcc On/Off Reac-tion Cuvette System
39	20C	P06	I2CSDAC	Serial Data Line

40	20A	P07	I2CSCLC	Serial Clock Line
41	21C	P92	E_P7C	Enable Start Pump P7
42	21A	PA0	D0_C	Bit D0 A/D
43	22C	PA1	D1_C	Bit D1 A/D
44	22A	PA2	D2_C	Bit D2 A/D
45	23C	PA3	D3_C	Bit D3 A/D
46	23A	PA4	D4_C	Bit D4 A/D
47	24C	PA5	D5_C	Bit D5 A/D
48	24A	PA6	D6_C	Bit D6 A/D
49	25C	PA7	D7_C	Bit D7 A/D
50	25A	PB0	RESET_PIC	Reset Micro-controller Photometer
51	26C	PB1	E_PRC	Enable Start Cuvette Washing Arm
52	26A	PB2	S_BYTE	Selection Byte A/D Converter
53	27C	PB3	E_PIC	Enable Start Plate Rotation
54	27A	PB4	E_P3C	Enable Start Pump P3
55	28C	PB5	PR_LOWC	Low power Motor Cu-vette Washing Probe.
56	28A	PB6	E_P8C	Enable Start Pump P8
57	29C	PB7	PI_LOWC	Low power Motor Plate
58	29A	PC0		
59	30C	PC1		
60	30A	PC2		
61	31C	PC3	GO	Go A/D Converter
62	31A	PC5	E_P5C	Enable Start Pump P5
63	32C	PC6	ONC_C	Enable Air Pump
64	32A	PC7	VALVE_V4C	Enable Valve V4
		P20		
		P90		
		P91		
		P93		
		PC4	BEEPER	Acoustic Signal

Table signals CPU Sample System

Item	Terminal J1	Label U1-U8	Signal Label	Description
1	1A	+5V		Power supply 5v
2	1C	+5V		Power supply 5v
3	2A	GND		Digital Ground
4	2C	GND		Digital Ground

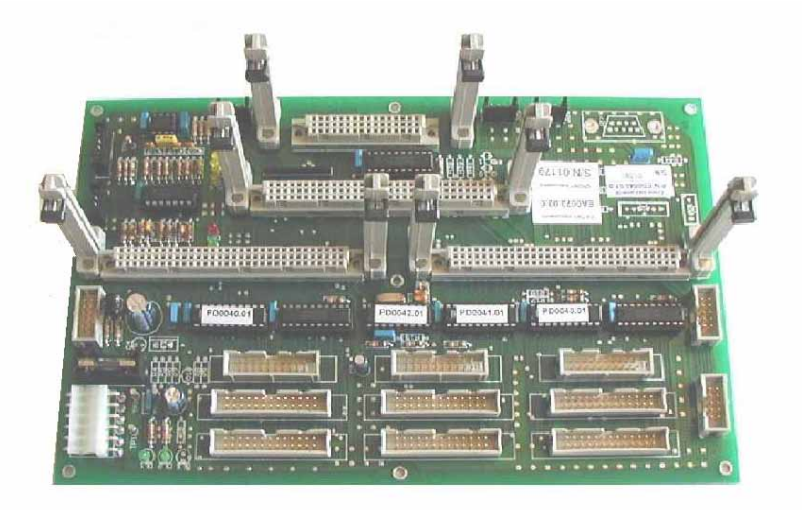
5	3A	+12V		Power supply 12v
6	3C	AGND		Ana logic GND
7	4C	P30	TX232CA	Transmission Data Line
8	4A	P31	RX232CA	Receiving Data Line
9	5C	P70		
10	5A	P71		
11	6C	P72		
12	6A	P73		
13	7C	P74		
14	7A	P75		
15	8C	P76		
16	8A	P77		
17	9C	P21	HOME_DCA	Flag Home Diluter D1 Samples
18	9A	P22		
19	10C	P23	SENSOR_LCA	Signal Sensor Sample Liquid Level
20	10A	P24	HOME_PRCA	Flag Home Sample Probe
21	11C	P25	HOME_PICA	Flag Home Sample Plate
22	11A	P26	HOME_BRCA	Flag Home Sampling Arm
23	12C	P27	SYNC_DCA	Flag Sync Diluter D1 Sample
24	12A	P32	SYNC_0	
25	13C	P33	SYNC_1	
26	13A	P34	SYNC_2	
27	14C	P80	A_CLKCA	Signal Clock
28	14A	P81	B_CLKCA	Signal Clock
29	15C	P82	E_P4CA	Enable Start Pump P4
30	15A	P83	E_MIXERCA	Enable Mixer
31	16C	P84	ONC_CA	Enable Air Pump
32	16A	P85	PR_CWCA	Direction Sample Probe
33	17C	P00	D_CWCA	Direction Diluter D1 Sample
34	17A	P01		
35	18C	P02	BR_CWCA	Direction Sampling Arm
36	18A	P03	PI_CWCA	Direction Sample Plate
37	19C	P04	E_PRCA	Enable Up/Down Sample Probe

38	19A	P05	PWR_ONCA	+24/Vcc On/Off Sampling System
39	20C	P06	I2CSDACA	Serial Data Line
40	20A	P07	I2CSCLCA	Serial Clock Line
41	21C	P92		
42	21A	PA0		
43	22C	PA1		
44	22A	PA2		
45	23C	PA3		
46	23A	PA4		
47	24C	PA5		
48	24A	PA6		
49	25C	PA7		
50	25A	PB0	E_DCA	Enable Diluter D1 Sample
51	26C	PB1	E_P1CA	Enable Pump P1
52	26A	PB2	E_BRCA	Enable Sampling Arm
53	27C	PB3	E_PICA	Enable Sample Plate
54	27A	PB4	D_LOWCA	Low power motor Diluter D1
55	28C	PB5	P1_LOWCA	Low power motor Pump P1
56	28A	PB6	BR_LOWCA	Low power motor Sampling Arm
57	29C	PB7	PI_LOWCA	Low power motor Sample Plate
58	29A	PC0		
59	30C	PC1		
60	30A	PC2		
61	31C	PC3	PR_LOWCA	Low power motor Sampling Probe
62	31A	PC5		
63	32C	PC6		
64	32A	PC7		
		P20		
		P90		
		P91		
		P93		
		PC4	BEEPER	Acoustic Signal

6.2 Mother Board (P/N: 17970/9)

TECHNICAL DESCRIPTION

The Mother Board receives all the signals from the three CPU slaves, A/D Converter as well as from all the other modules present in the analyzer.



The functions of the board **17970/9** are:

- To Interface the CPU, Reagents, Measurement and Sampling Systems, in connectors J14, J17 e J15
- To Interface the A/D converter board, in connector J23.
- To control through U3, photometer filter revolver.
- To control through U7, the following Liquid Level Sensors:
  - Flag [**AWASH**] Minimum Liquid Level in container for Incubation bath. (signal SENSOR_S1L)
  - Flag [**WASH**] Minimum Liquid Level in Wash Solution Container (signal SENSOR_S3L)
  - Flag [**TB HIGH**] Maximum Liquid Level inside Incubation Bath. (signal SENSOR_S4L)
  - Flag [**TB LOW**] Minimum Liquid Level inside the Incubation Bath. (signal SENSOR_S5L)
  - Divides the power supply of +5V, through fuse F1.
- Divides the power supply of +5V, through fuse F1.

! Fuse F1 protects the line of +5V, from the digital sections of all boards.

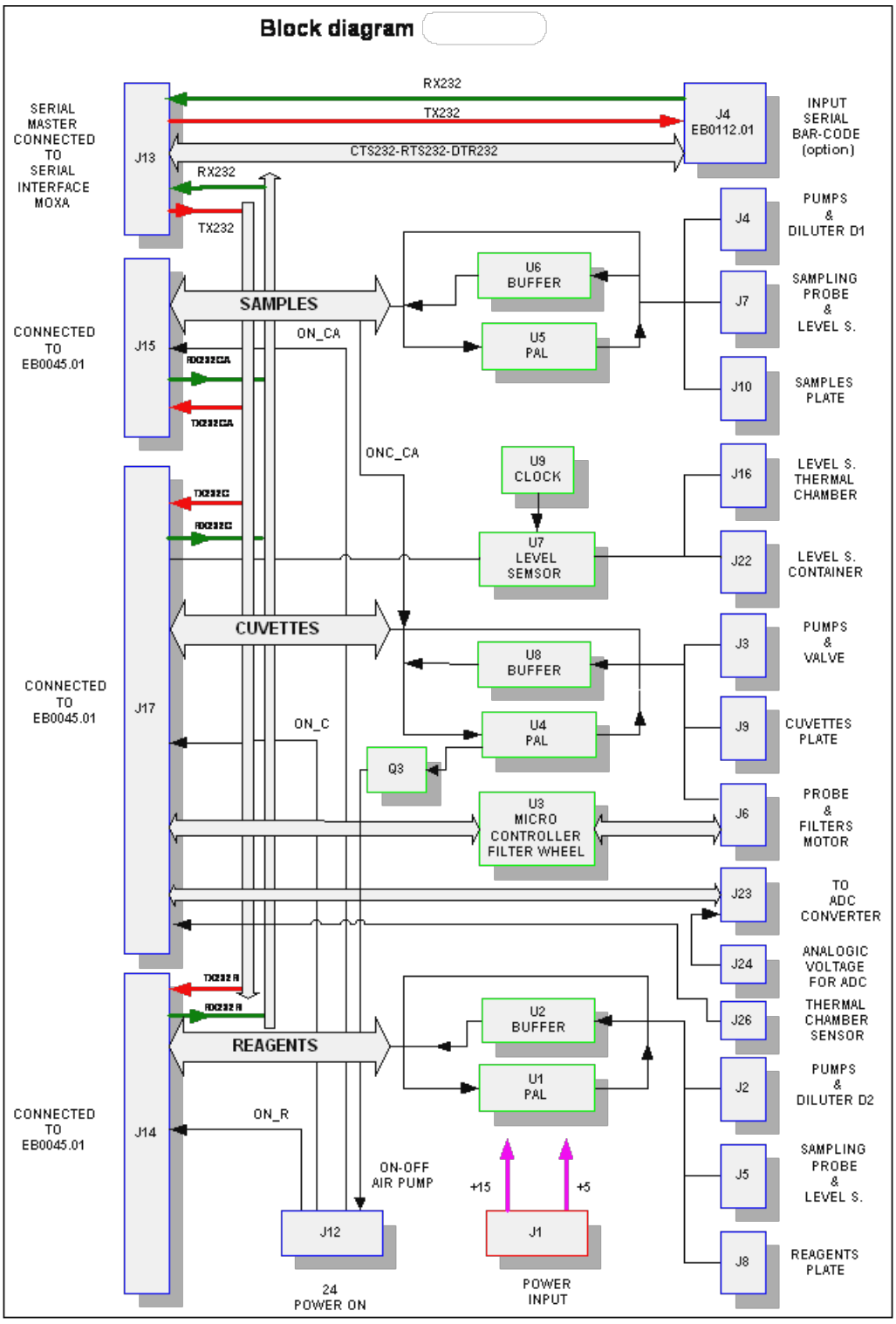

Block diagram
SERIAL MASTER CONNECTED TO SERIAL INTERFACE MOXA
J13
RX232
TX232
CTS232-RTS232-DTR232
J4 EB0112.01
INPUT SERIAL BAR-CODE (option)
RX232
TX232
J4
PUMPS & DILUTER D1
U6 BUFFER
U5 PAL
SAMPLES
J7
SAMPLING PROBE & LEVEL S.
CONNECTED TO EB0045.01
J15
ON_CA
J10
SAMPLES PLATE
ONC_CA
U9 CLOCK
J16
LEVEL S. THERMAL CHAMBER
U7 LEVEL SEMSOR
J22
LEVEL S. CONTAINER
CUVETTES
J3
PUMPS & VALVE
U8 BUFFER
CONNECTED TO EB0045.01
J17
ON_C
U4 PAL
J9
CUVETTES PLATE
Q3
U3 MICRO CONTROLLER FILTER WHEEL
J6
PROBE & FILTERS MOTOR
J23
TO ADC CONVERTER
J24
ANALOGIC VOLTAGE FOR ADC
J26
THERMAL CHAMBER SENSOR
REAGENTS
U2 BUFFER
U1 PAL
J2
PUMPS & DILUTER D2
CONNECTED TO EB0045.01
J14
ON_R
ON-OFF AIR PUMP
+15
+5
J5
SAMPLING PROBE & LEVEL S.
J12
J1
J8
REAGENTS PLATE
24 POWER ON
POWER INPUT

FIGURE 24
Clock Signal U9, terminal TP6

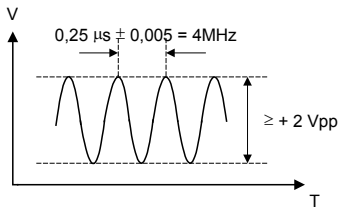


FIGURE 25
Clock Signal U3, terminal TP5

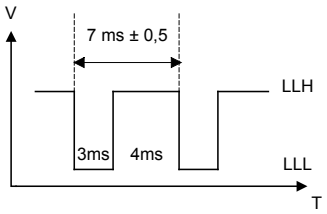


TABLE 7
Nominal Voltages

Item	Test point	Range
1	TP2	From + 11,0V to + 12,5V
2	TP3	From + 4,75V to + 5,25V
3	Pin 1 J24	From + 22V to + 24V
4	Pin 4 J24	From - 22V to - 24V

All Voltages are referred to GND = AGND = TP1

FIGURE 26
Level Sensor Signals

Ref.	Terminal	Range	Function
1	12 U7	From LLH to LLL	Flag [**AWASH**] Minimum Liquid Level inside the container of liquid for Incubation bath .
2	10 U7	Da LLH to LLL	Flag [**WASH**] Minimum Liquid Level in Wash Solution Container
3	2 U7	Da LLH to LLL	Flag [**TB HIGH**] Maximum Liquid Level in Incubation Bath.
4	6 U7	Da LLL to LLH	Flag [**TB LOW**] Minimum Liquid Level in Incubation Bath.

FIGURE 27
Visible Liquid Level Sensor voltages

LED	Color	Function
DL1	Green	[+ 12 V]
DL2	Green	[+ 5 V]
DL5	Red	[TB HIGH]
DL4	Green	[TB LOW]
DL7	Yellow	[WASH]
DL6	Yellow	[AWASH]

Board	Description	Device	Layout Ref.	Software P/N
17970/9	Mother Board	GAL16V8	U1	PD0040.01
17970/9	Mother Board	PIC16F84A	U3	PD0042.01
17970/9	Mother Board	GAL16V8	U4	PD0041.01
17970/9	Mother Board	GAL16V8	U5	PD0040.01

FIGURE 28
List of Pragrammable Devices

DOCUMENTATION

17970/9.A.SC (electrical diagram)
17970/9.B.PM (assembly drawing)

6.3 Maintenance

Remove the outside panels. (see “General Maintenance” section “Removal of outside panels”)

! Operations to be done with analyzer turned OFF.

6.3.1 CPU SLAVE BOARD REPLACEMENT

1. Remove the two locks holding the board.

! Note: In replacing the CPU slave (2) reading, check the correct value of temperature displayed on the monitor.

6.3.2 MOTHER BOARD REPLACEMENT

2. Disconnect all connectors and remove all screws.
3. **In replacing the board make sure not to invert the connectors of the same type. Follow the block diagram.**

6.4 Trouble Shooting Guide

This section lists a series of symptoms and problems and how to solve them. To solve some of the problems use the Diagnostic Program "HUMASTAR 300 TOOLS".

Defect	Causes and Remedies
There are NO FLAG WARNINGS on the following: Liquid Level inside container for the Incubation bath (AWASH). Liquid Level inside Wash solution container (WASH). The flag AWASH e WASH work perfectly on Mother Board, but program does not give any WARNING.	Possible that the sensors **AWASH** and **WASH** are damaged. Remove the sensor connector and check the continuity of the sensor electrode. Check the continuity connection between board **17970/9** and the sensor connector. Replace the sensor Check fuse F1 - Check on J7 +5V (pin 1-2/3-4) - Check power supply PC **17956/1**, if necessary replace. (see section 1)
The flag AWASH e WASH work perfectly on Mother Board, but program does not give any WARNING.	Replace board **17970/9** Most probably the CPU slave board Cuvette Measuring System is damaged. - Replace U1 board CPU **17970/8** - Replace board **17970/9**
NO flag WARNING on Max. Liquid Level inside Incubation Bath (TB HIGH)	- Possibly sensor damaged inside Incubation bath. - Remove connector P1 of cable WC0099.01 and check if red DL5 is OFF, otherwise: - Check the continuity of connection Sensor-Cable – Connector. - Replace the Sensor Assembly **17941/3** - Replace U7 - Replace board **17970/9**
Flag TB HIGH works on Mother Board, but program does not show the WARNING.	- Probably board CPU slave Cuvette System is damaged - Replace U1 board CPU Cuvette System **17970/8** - Replace board **17970/9**

NO Flag WARNING is given when Liquid Level inside incubation bath is low (TB LOW)	- Possibly the sensor inside the incubation bath is damaged. - Remove connector P1 from cable WC0099.01 and check that the green DL4 is ON, otherwise: - Check the continuity of connection Sensor-Cable-Connector. - Replace the assembly sensors **17941/3** - Replace U7 - Replace board **17970/9**
Flag TB LOW works perfectly on the Mother Board, but program-does not flag the WARNING.	- Probably the CPU slave board Cuvette Plate is damaged Replace U1 board CPU Cuvette Plate **17970/8** - Replace board **17970/9**
The Operating Program flags WARNING that Incubation Temperature inside bath is not within the specifica-tions.	- Make sure there is liquid inside the container supplying liquid to the Thermostat AWASH . - Check the liquid level inside the Incubation bath. - Measure the temperature with a precision, it should be = 37,2 °C, if necessary ad just with R26 on board **17970/7** (for the exact procedure see this section in "General Maintenance" - Check on J26 pin 1 about +3,08V, board **17970/9** - Replace the temperature sensor EA0098.01 - Check on pin 8C of J1 about +3,08V, board **17970/8** cuvette - Check the continuity between J25-pin 1 - **17970/9** and J1-pin 8C - **17970/8** Cuvette System.
Temperature displayed on the monitor does not correspond to that measured with a precision thermometer.	- Adjust PR1 (less then ¼ turn), CPU board (Cuvette Sys-tem) **17970/8** to make both temperature readings equal within ± 0,5 °C (reference voltage from +4,90V to + 5,10V)
Program flags a Temperature Warning.	- Check as above. See also " **Incubation bath goes not heat**" in section 1.

When turning ON the analyzer, NO acoustic (Beep) is heard from the CPU slave board.	- Missing the +5V power supply, Check fuse F1 - Check on J1 +5V (pin 1-2/3-4) - If fuse is burned, remove all the flat cables, then insert one at a time to identify the one that cause the fuse to blow.
Photometer filter wheel does NOT turn.	- Missing the +5V power supply, check fuse F1 - Check on J1 +5V (pin 1-2/3-4) - Check voltage + 24V, red LED should be ON on the driver motor filters **17970/22** - Replace microcontroller U3 PD0042.01 - Replace microcontroller U3 PD0044.01 on **17970/19** - Replace board CPU Cuvette System **17970/8**
The stepper motors do NOT work	- Missing the +5V power supply, check fuse F1 - Check on J1 +5V (pin 1-2/3-4) - Check voltage + 24V, red LED should be ON driver motor filters EB0092.XX - Replace U1, U4 and U5 - Replace one at a time the CPU slave boards **17970/8**
AIR Pump does NOT work	- Check the power cable to the pump unit. - Check the fuses inside the socket. - Replace U4 - Replace one at a time the CPU slave boards **17970/8**
La CPU master (Pen-tium) does NOT communicate with the CPU slave boards.	- Check the correct connection of cable FC0069.01 - Replace cable FC0069.01 - Replace all 3 CPU slave boards, Sample, Cuvette and Reagents- **17970/8** - Replace the multi-serial board 910.002.031

There are malfunctions during the operative programming and with the Diagnostic program	Proceed step by step as follows: - Make sure that the CPU master (pentium) works properly. - To find the problem, use the Diagnostic Program to check one at a time the section Reagents, Cuvette and the Sample Systems. - Proceed by checking from (DOWN) (position sensors, false connection contacts, the flat cables leading to the liquid sensor on the moving Probes, encoder in wrong positions, excessive friction in the moving parts, etc.) to finish with the more complex parts such as the electronic boards. - Once the cause of malfunction has been found, before re-placing the CPU slave, to confirm, invert the board with one of the others, if the defect is inverted – change the defective CPU slave board. (The 3 CPU slave boards are identical)

6.5 Spare Part List

Code	Sub_Code	Description	QTY
17970/8		● CPU slave	3
	PD0052.01	EEPROM U2	3
	PD0011.01	Programmable Device U5	3
	PD0012.02	Programmable Device U7	3
17970/9		Mother Board	1
	PD0040.01	Programmable Device U1-U5	1
	PD0042.01	Programmable Device U3	1
	PD0041.01	Programmable Device U4	1
	680.010.225	Fuses F1 - 2,5A	1

! To assure a rapid and efficient technical service to its clients, HUMAN suggests to keep in stock all the parts that are marked with (•). When Ordering parts, make sure to include: Code Number, Description and Quantity

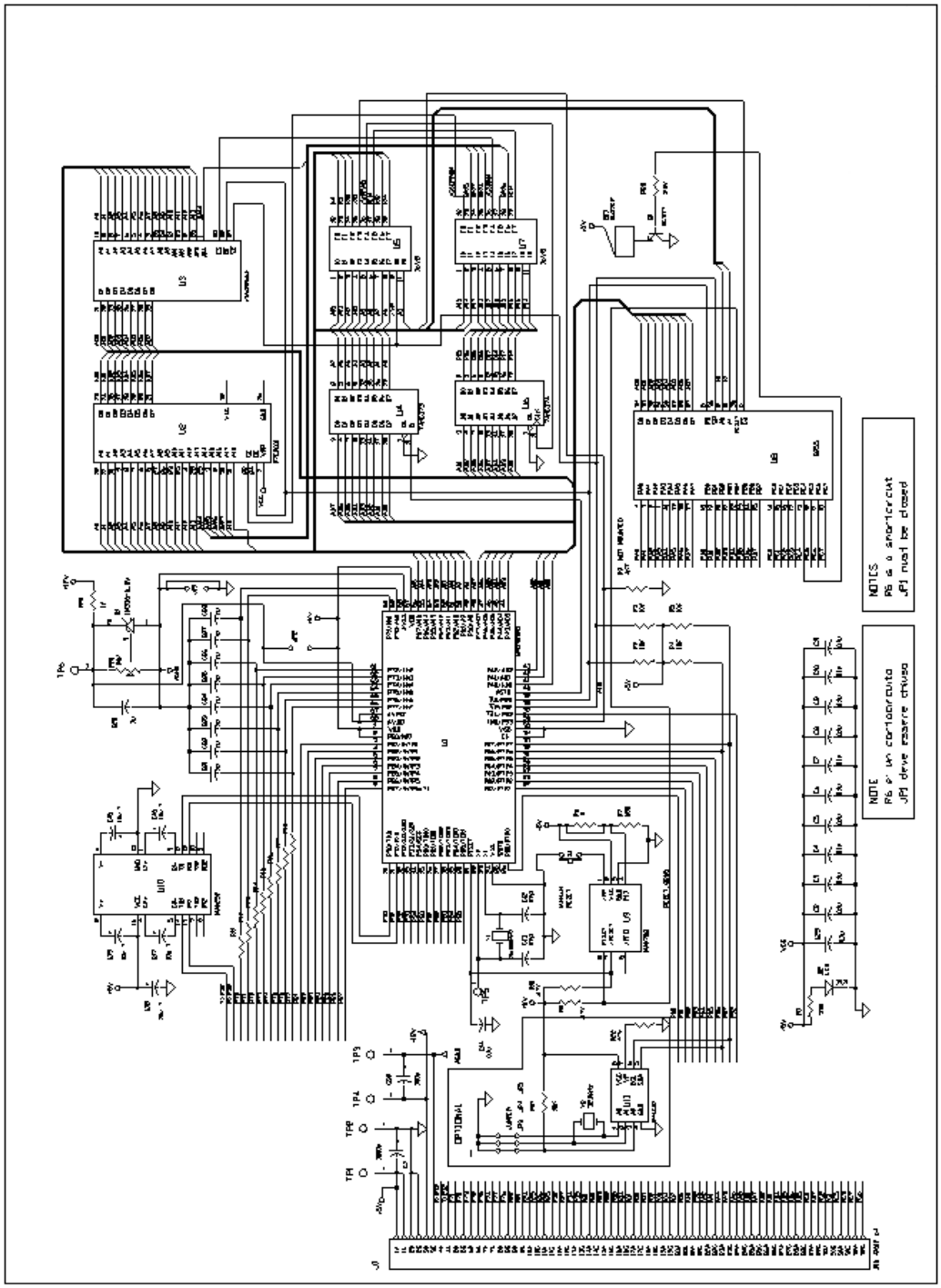
6.6 Enclosed Documentation

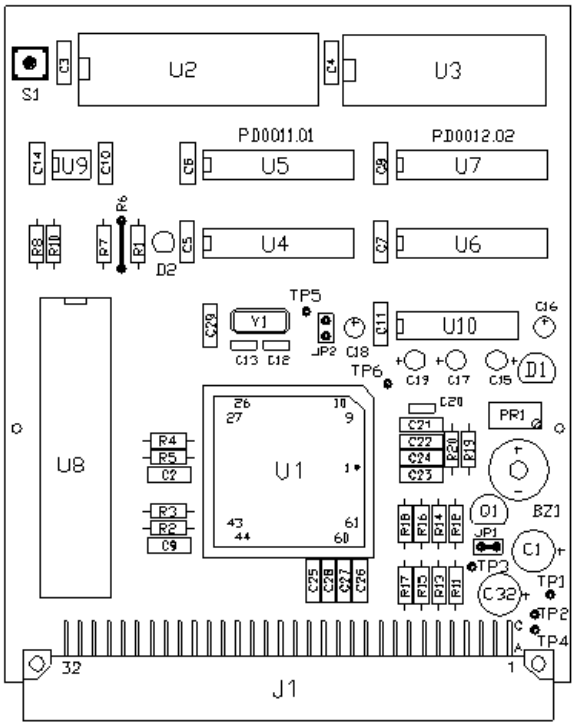
6.6.1 EB0045.00.B.SC (ELECTRICAL DIAGRAM)

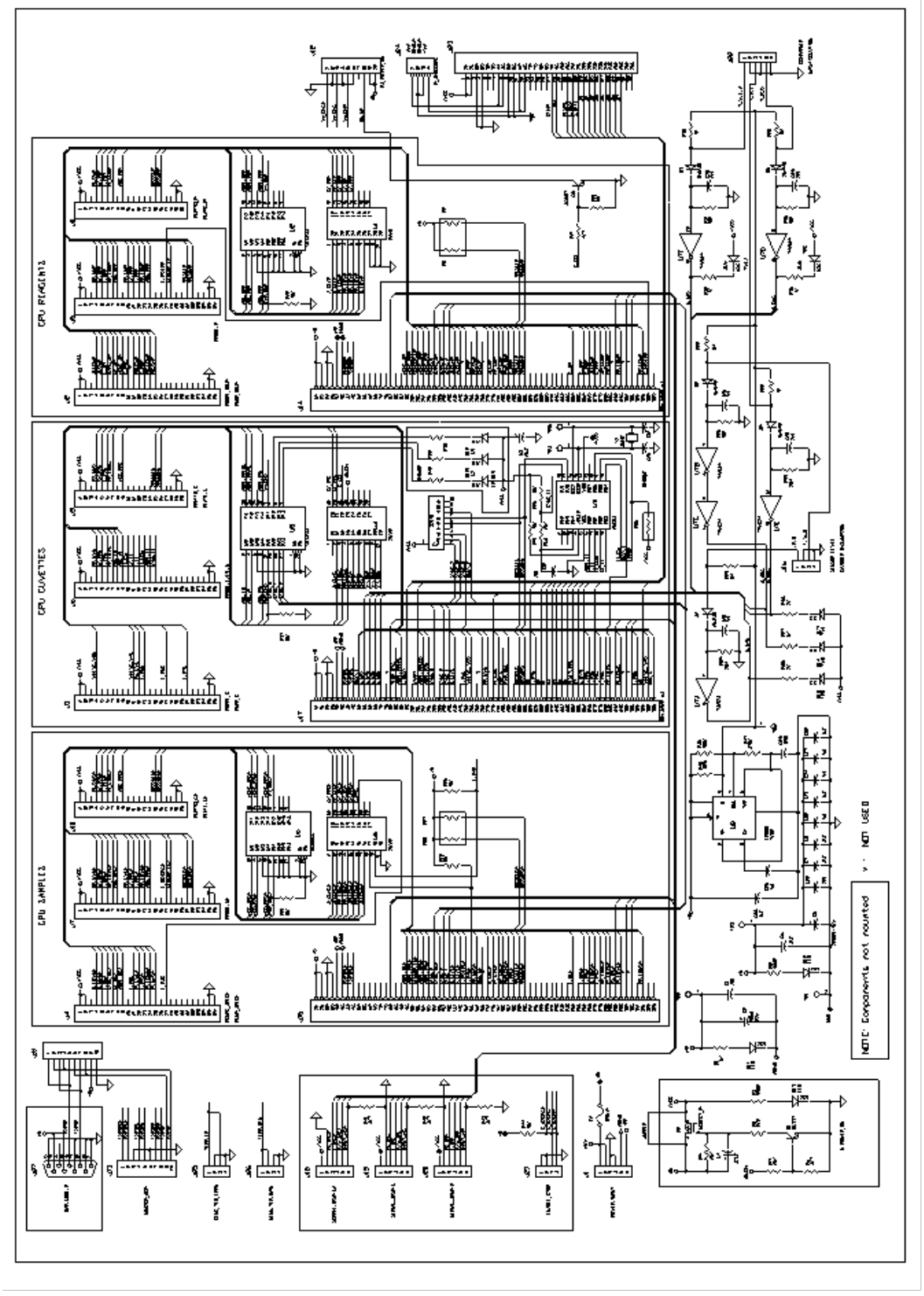
6.6.2 17970/8.A.PM (ASSEMBLY DRAWING)

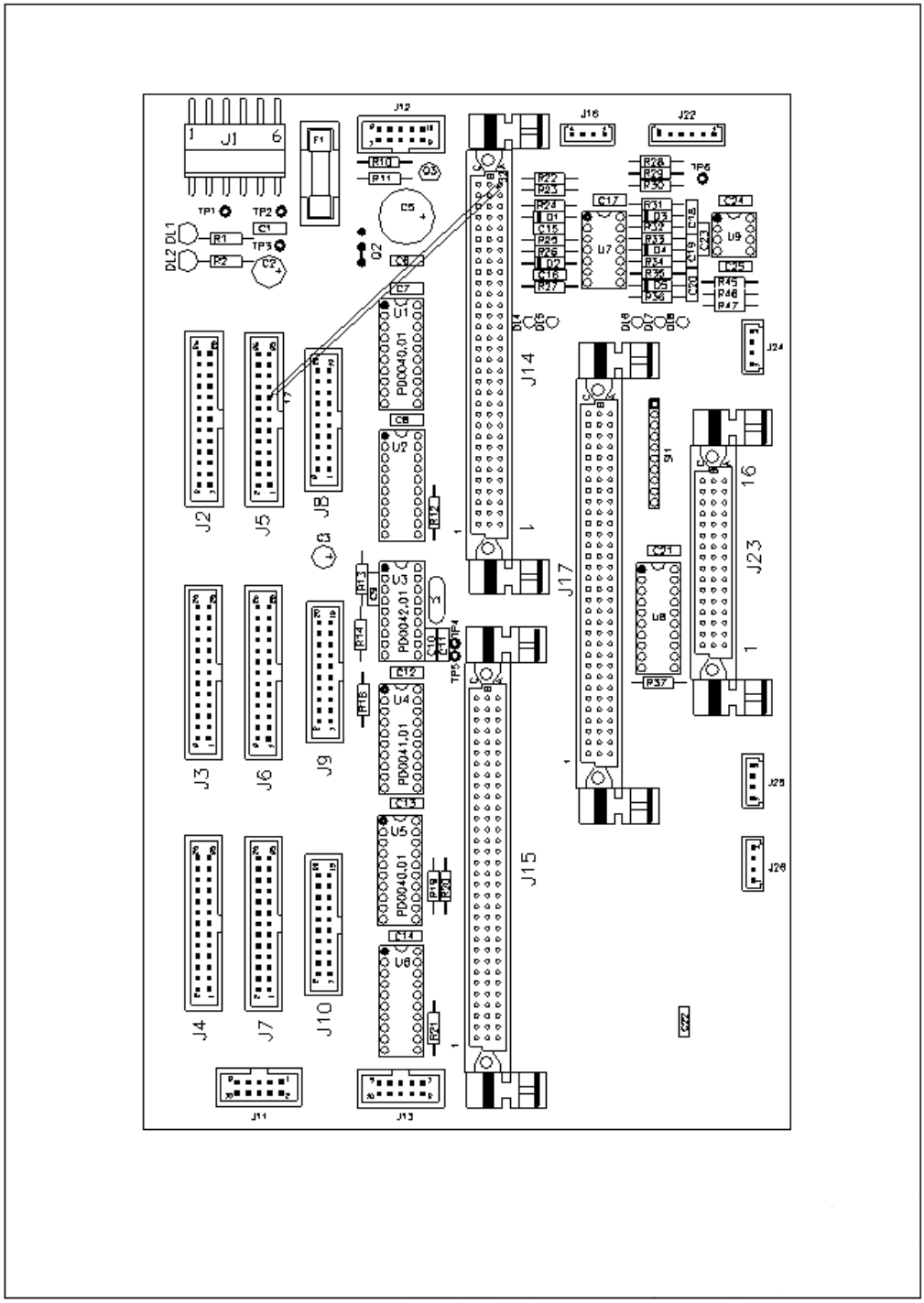
6.6.3 17970/9.A.SC (ELECTRICAL DIAGRAM)

6.6.4 17970/9.B.PM (ASSEMBLY DRAWING)


NOTE
Pb é um curto-circuito
JP1 deve estar fechado
NOTES
Pb is a short-circuit
JP1 must be closed


S1
C3
U2
C4
U3
PD0011.01
PD0012.02
C14
U9
C10
C6
U5
C9
U7
R6
R8
R10
R7
R1
D2
C5
U4
C2
U6
TP5
C29
Y1
C13
C12
JP2
C18
C11
U10
C16
TP6
C19
C17
C15
D1
C20
PR1
U8
R4
R5
C2
U1
C21
C22
C24
C23
R20
R19
R3
R2
C9
R18
R16
R14
R12
D1
BZ1
JP1
TP3
C1
C75
C28
C27
C26
R17
R15
R13
R11
C32
TP1
TP2
TP4
32
1
J1


CPU REAGENTS
CPU CUVETTES
CPU SAMPLES
NOTE: Components not mounted
* : NOT USED


J1
1
6
F1
TP1
TP2
TP3
DL1
DL2
R1
R2
C1
C2
J12
R10
R11
Q3
C5
Q2
C4
C7
U1
PD0040.01
C8
U3
PD0042.01
R12
J8
J2
J5
J14
J16
J22
J24
J17
J23
J25
J26
J15
J3
J6
J9
J4
J7
J10
J11
J13
U7
U9
U8
C17
C18
C19
C20
C21
C22
C23
C24
C25
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R45
R46
R47
D1
D2
D3
D4
D5
D6
D7
D8
TP6
S1
16
1

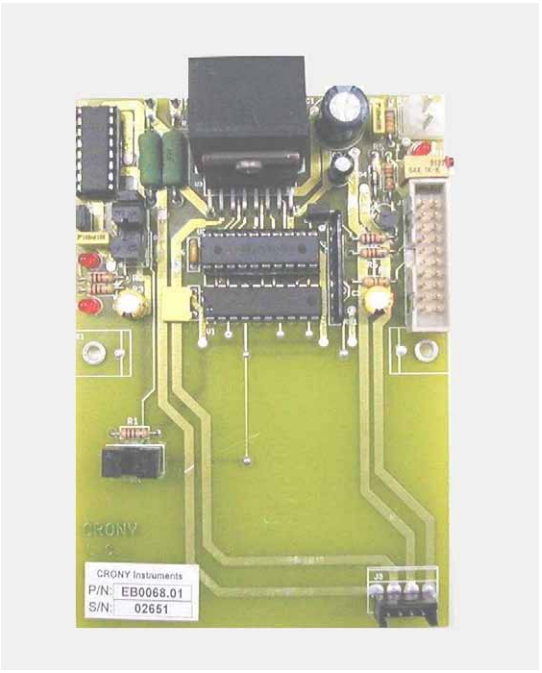
7 DILUTER DRIVER (P/N: 17970/11)

TECHNICAL DESCRIPTION

This PCB commands the stepper motor of the Diluter, which transforms the screw rotation into a linear movement of the syringe.

- Led (D1) is **ON**, indicating the presence of the **+ 24V** power supply.
- The mechanical **ZERO** position of the screw is obtained when both signals **HOME** e and **SYNC** are aligned.
  - Signal **SYNC** is obtained by means of a disc with a split fixed on the screw and an Opto OC2. The correct position of the SYNC is when LED (D2) is ON.
  - The **HOME** signal is obtained by a flag fixed on a support that moves along the linear screw and an Opto OC1. When the flag is aligned with the Opto, it generates the signal **HOME** and **LED** (**D3**) is **ON**.

In block diagram are shown the two timing of (**HOME** and **SYNC**) that determine the mechanical position of **ZERO**. This is when the **HOME** signal is on logic level **LLH** and signal **SYNC** is on **LLL**.



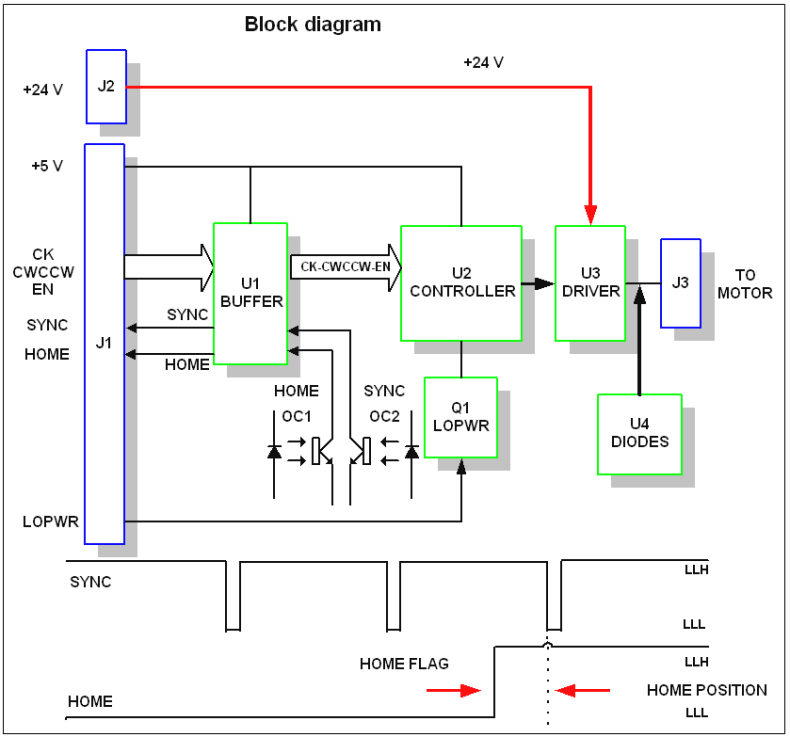


FIGURE 29
Nominal Voltages

Item	Test point	Range
1	Pin 1 J2	From +23,5V to +24,5V
2	Pin 20 U1	From +4,75V to +5,25V
3	Pin 15 U2	From +690 to +710mV Reg. PR1 (with piston moving)
4	Pin 15 U2	Da +90 a +120mV (with piston in stand still)

All voltages are referred to GND-D = GND-A = TP3

FIGURE 30
Setting jumpers

JP1	Closed
JP2	Closed
JP3	Closed

DOCUMENTATION

17970/11.A.SC (electrical diagram)
17970/11.C.PM (assembly drawing)

7.1 Maintenance

Remove the outside panels. (see “General Maintenance” – removal of outside panels)

7.1.1 REPLACEMENT OF DRIVER BOARD

(See Figure 29)

! Operation to be done with the Analyzer turned OFF.

! For Diluter maintenance see Section 13

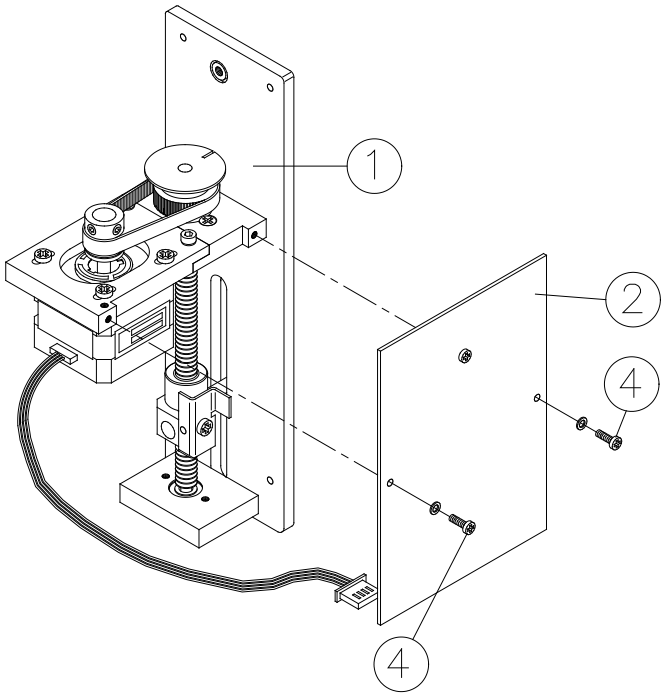


FIGURE 31

1. Disconnect the tubing and remove the syringe.
2. Remove connectors (J1, J2) from driver board P/N: **17970/11** (2).
3. Take out the Diluter module.
4. Remove screws (4) that hold the board and remove the connector from the motor.
5. Replace the board and reassemble.

7.2 Trouble Shooting Guide

This section lists a number of symptoms and problems and how to solve them. To solve some of the problems use the Diagnostic Program "**HumaStar 300 TOOLS**".

Defect	Causes and Renedies
Syringe piston does NOT move	- Check the start up voltage of PWR ON of the Reagent and Sampling Systems. (See also „3.5 Trouble Shooting Guide".) - Check Fuses F2 - F3 on board EB0093.01 - Check voltage +24V on J2 - Replace board **17970/11** - Replace the CPU slave board Reagents **17970/8** - Replace the CPU slave board Sampling **17970/8**
Syringe piston makes irregular moves and tends to lock.	- Not enough lubrification on moving screw, if necessary lubricate witha few drops of very light oil. - Voltage + 24V out of specification (< 20V), check voltage +24V on J2 - Replace CPU slave board Reagents **17970/8** - Replace CPU slave board Sampling **17970/8** - Replace the stepper motor . (see procedure in chapter 15)
Using the Diagnostic Program the piston does not move.	- Make sure to have entered a value that was not 0 (zero) (max=6000), in window "µl". - Make sure to have done a HOME position to all the movements in the Diluter.

7.3 Spare Part List

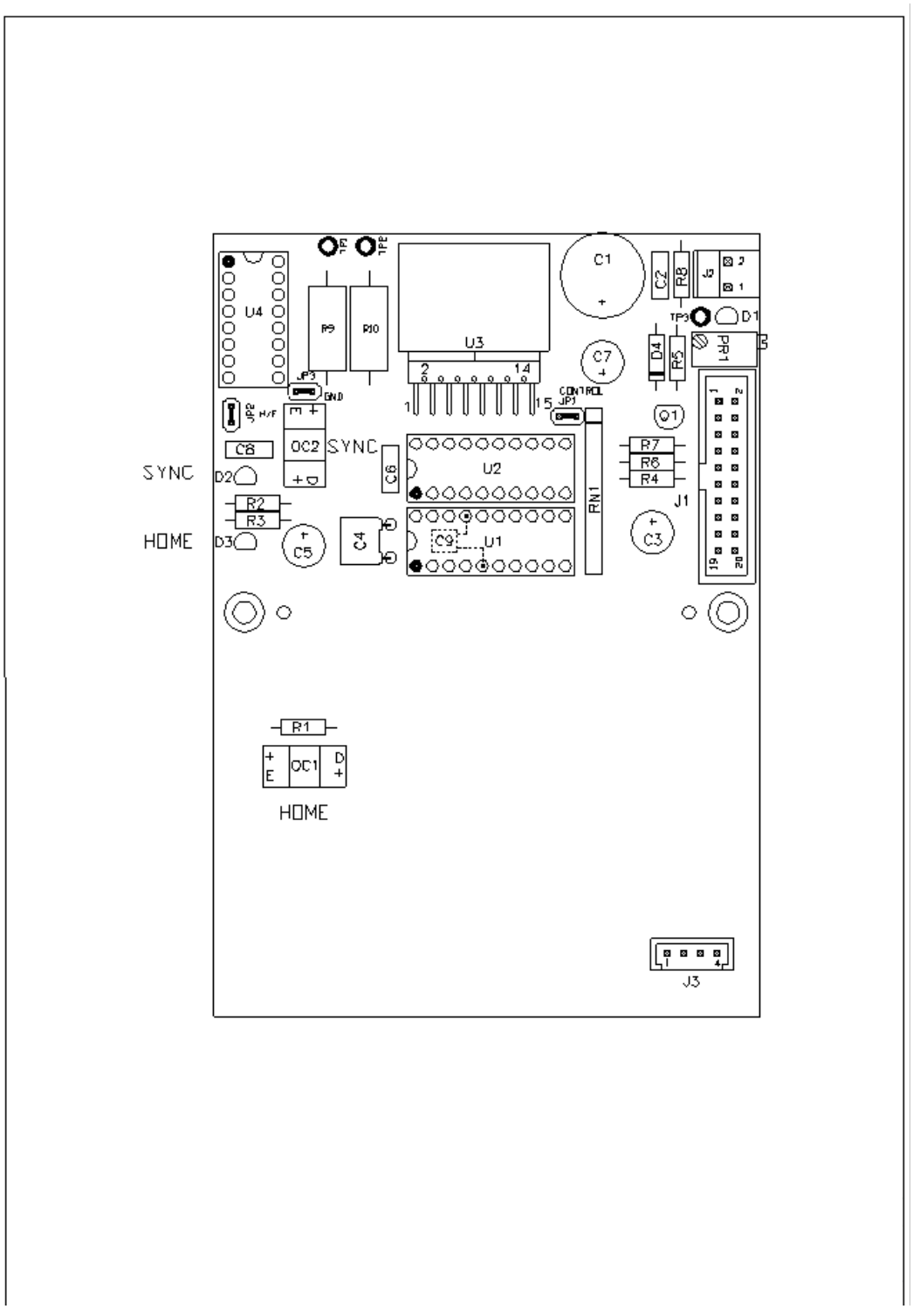
Code	Sub_Code		Description	QTY
17915			Complete Sample Diluter Module	1
17916			Complete Reagent Diluter Module	1
	17970/11	•	PCB driver	1
	EM0011.01		Stepper motor	1

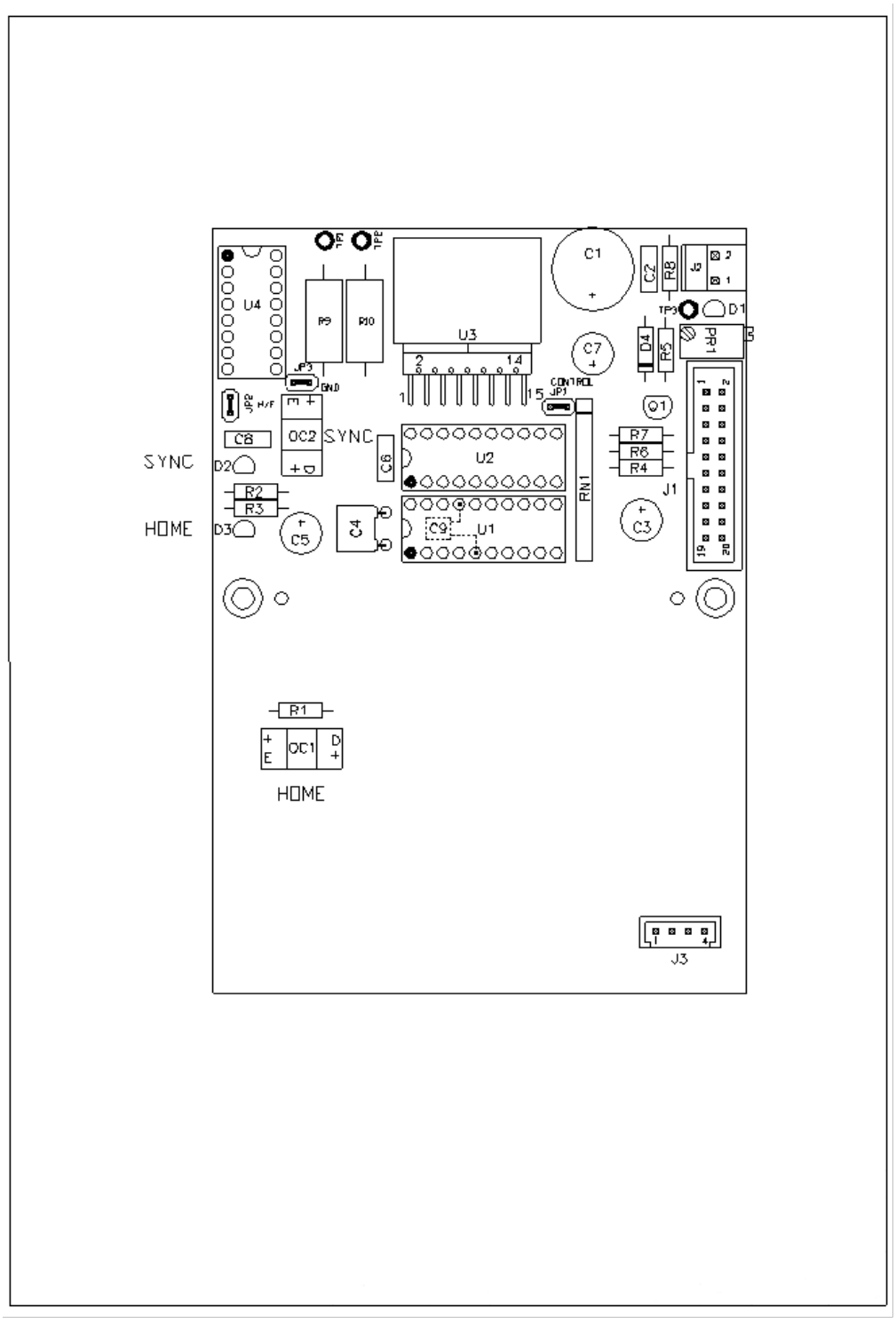
! To assure a rapid and efficient technical assistance to its clients, HUMAN suggests to keep in stock all the parts marked with an (•). When ordering parts make sure to include: Code Number, Description and Quantity.

7.4 Enclosed Documentation

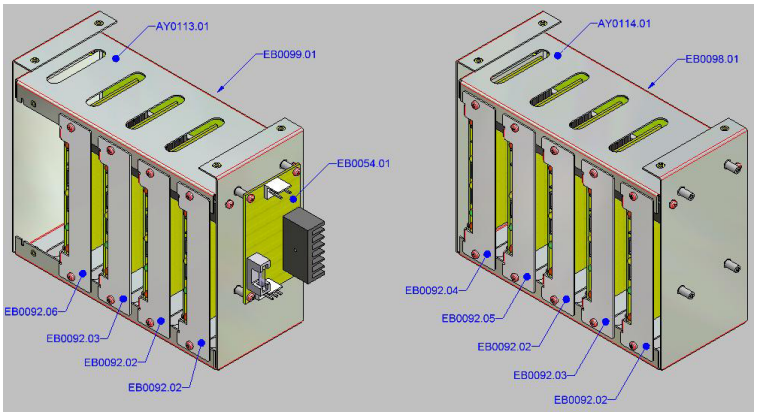
7.4.1 17970/11.A.SC (ELECTRICAL DIAGRAM)

7.4.2 17970/11.C.PM (ASSEMBLY DRAWING)


SYNC
HOME
U4
U3
U2
U1
C1
C2
C3
C4
C5
C6
C7
C8
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
RN1
D1
D2
D3
D4
Q1
J1
J3
J5
PR1
JP1
JP2
JP3
TP1
TP2
TP3
OC1
OC2
SYNC
HOME


SYNC
HOME
U4
R9
R10
U3
C1
C2
R8
J2
D1
C7
D4
R5
PRT1
C8
OC2
SYNC
C6
U2
R7
R6
R4
J1
R2
R3
D3
C5
C4
C9
U1
RN1
C3
R1
OC1
HOME
J3

8 MOTOR CONTROL ASSEMBLY (P/N:AY0113.01, AY0114.01)



TECHNICAL DESCRIPTION

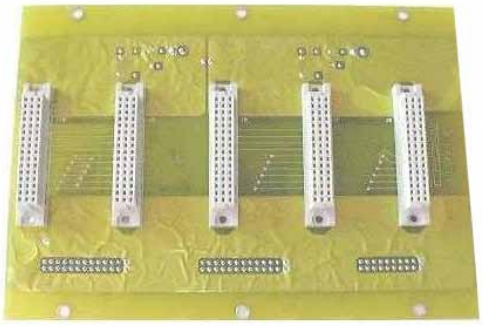
Containers AY0113.01 and AY0114.01 hold the modules that control the stepper motors. On the side of AY0114.01 is inserted the power supply board for the photometer lamp.

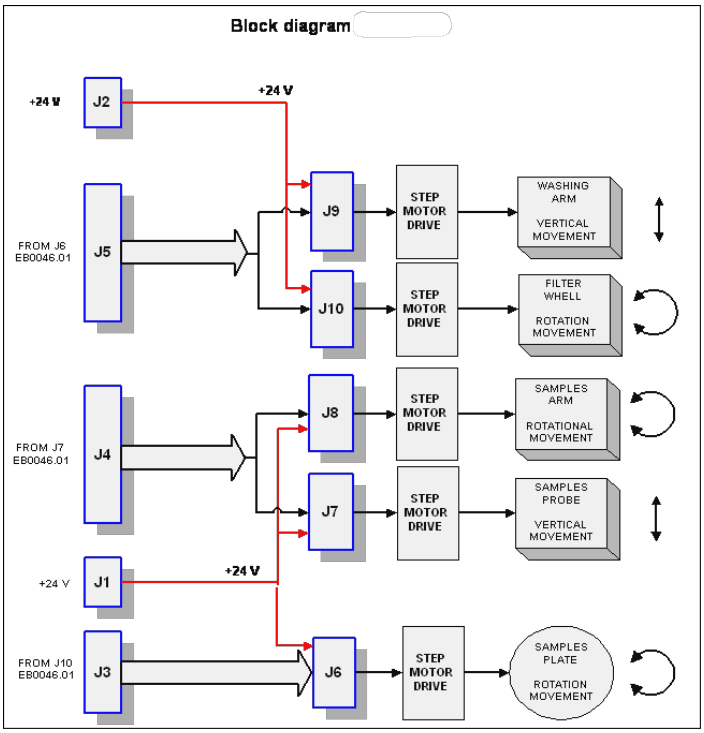
8.1 M/B Motor Control Motor (P/N: 17970/26)

TECHNICAL DESCRIPTION

The function of this module is to interface the drivers that control the stepper motors of the Sampling System and that of the Cuvette Measuring System.
The interface has the following characteristics:

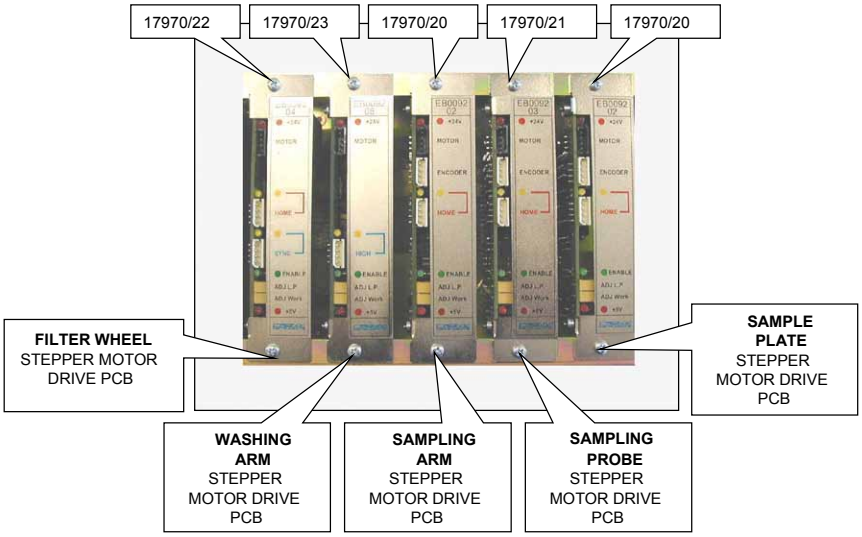
- J1 and J2: Input voltage +24V for the driver modules
- J3: Input signals from the Sampling System via J6.
- J4: input signal from Sampling arm activated by the driver modules, J7 (vertical movement), J8 (rotational movement).
- J5: input signal from cuvette washing arm activated by driver modules J9 and input signal from photometer activated by driver module J10.





In fig. 30 are indicated the modules in container AY0113.01

FIGURE 32



! We highly suggest NOT to modify the positions of the modules. When replacing - use modules with the same codes indicated in front of each module.

JP1	Closed

FIGURE 33
Settings jumpers

DOCUMENTATION

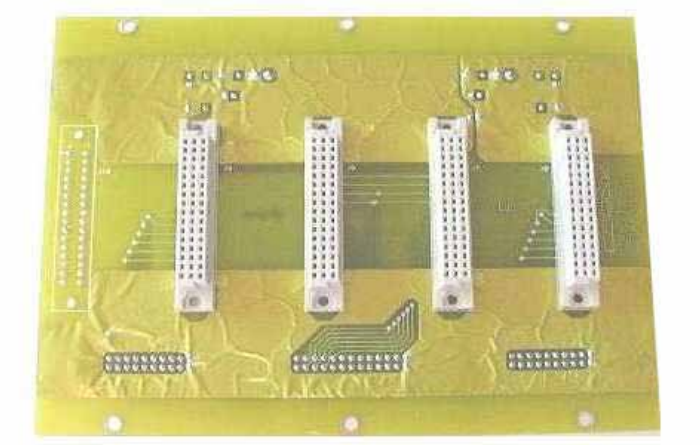
17970/26.A.SC (electrical diagram)
17970/26.A.PM (assembly drawing)

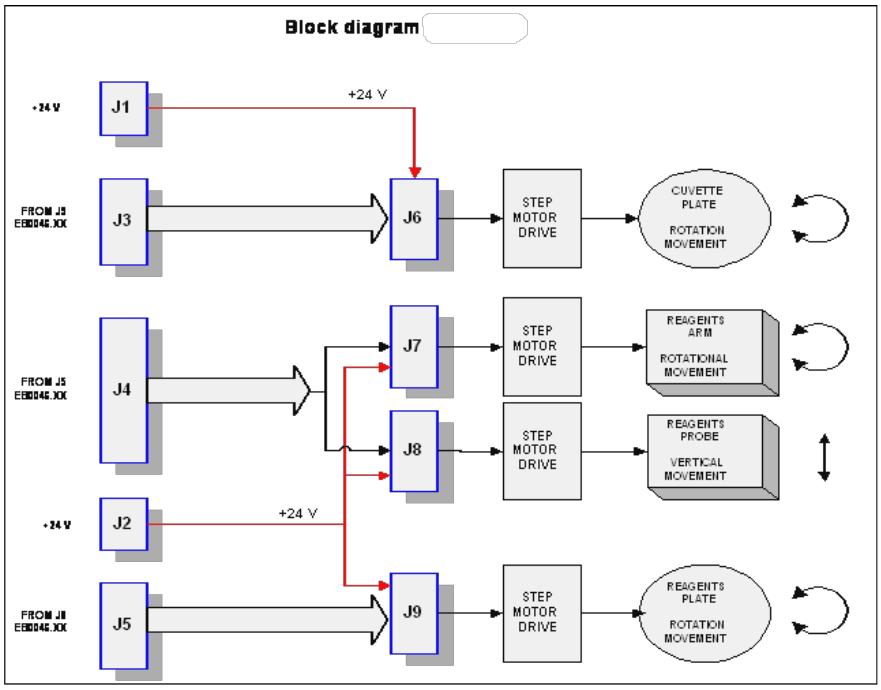
8.2 M/B Motor Control (P/N: 17970/26)

TECHNICAL DESCRIPTION

The function of this module is to interface the drivers that control the stepper motors in the Sampling and the Cuvette measuring Systems.
The Interface has the following characteristics:

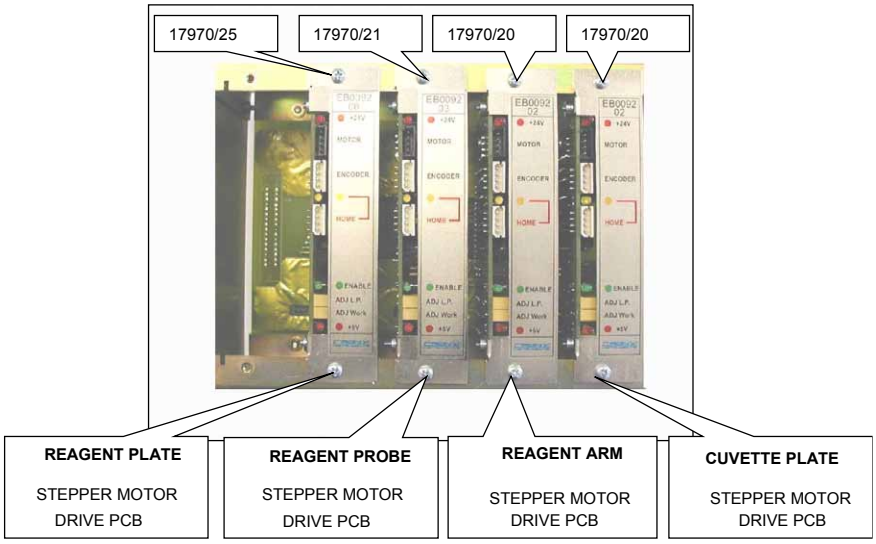
- J1 and J2: input +24V for driver modules
- J3: input signals from cuvette plate activated via transition into driver module on J6.
- J4: input from reagent Arm via the transition of driver module, J8 (vertical move-ment), J7 (rotational movement).
- J5: input signal from Reagent Plate activated via transition of driver module J9.





In „Figure 34“ are shown the modules in container AY0114.01

FIGURE 34



We highly suggest NOT to modify the positions of the modules. When replac-ing - use modules with the same codes indicated in front of each module.

JP1	Closed

TABLE 8
Setting jumpers

DOCUMENTATION

17970/26.A.SC (electrical diagram)
17970/26.A.PM (assembly drawing)

8.3 Driver For Stepper Motor (P/N:17970/20 - 23)

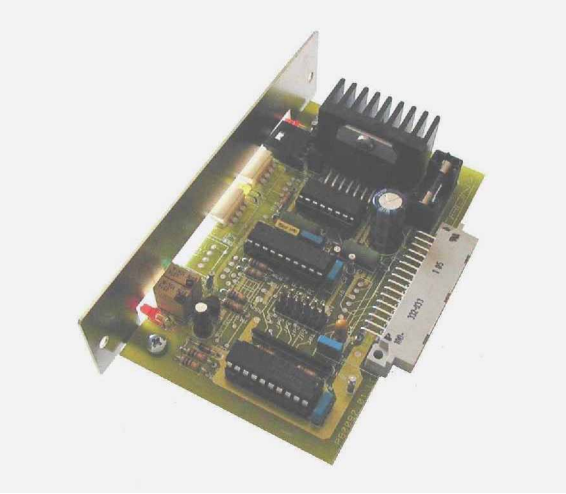
TECHNICAL DESCRIPTION

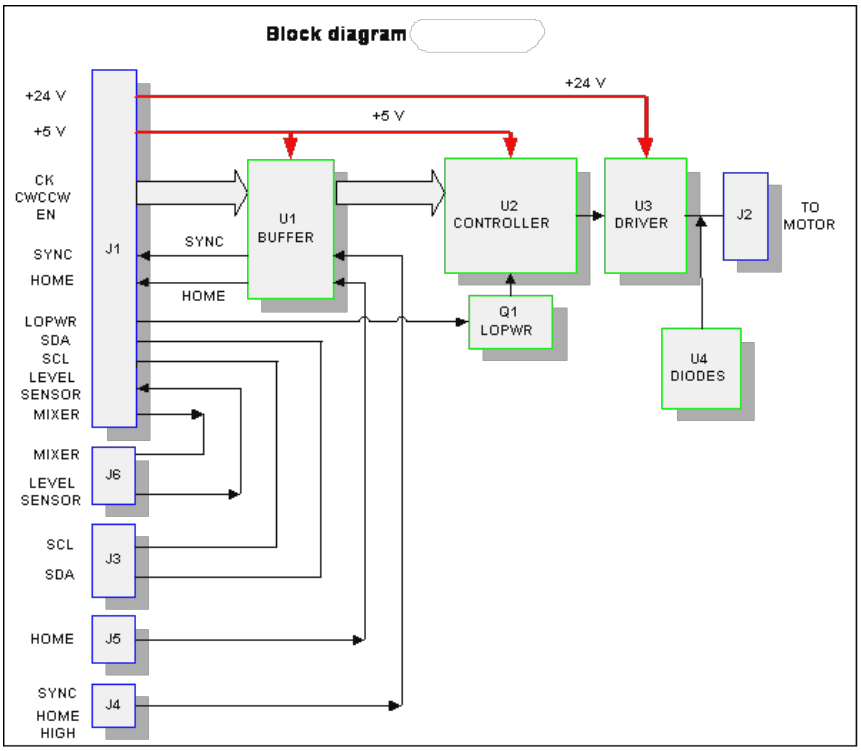
Function of this board is to:

- Control the stepper motor.
- Keep the motor under charge during stand-by.
- Give sense of rotation
- Select the +24V, via fuse F1.

To interface the following logical signals:

- Flag of SYNC and HOME of the Opto-couples.
- ON/OFF of the Mixer motor.
- Timing sensor of the Probe Level
- Timing SCL (serial clock) e SDA (serial data) for the serial transmission of the ENCODER.





Hardware Configuration

Table 9 indicates for each board, the calibration voltage, and position of jumpers.

TABLE 9

! DO NOT change the position of the jumpers.

Version	Range mV	Test point	Current (A)	Adj.	Setting jumpers JPX O=Open, C=Closed							Description Low power=STAND-BY
					1	2	3	4	5	6	7	ADJ. CURRENT
EB0092.02	400 800	TP3	0,4 0,8	PR1 PR2	O	O	O	O	O	O	O	Low power work
EB0092.03	250 800		0,25 0,8	PR1 PR2	O	O	O	O	O	O	O	Low power work
EB0092.04	100 500		0,1 0,5	PR1 PR2	O	O	O	O	O	O	O	Low power work
EB0092.05	100 800		0,1 0,8	PR1 PR2	O	O	O	O	O	O	O	Low power Work
EB0092.06	400 1000		0,4 1	PR1 PR2	O	O	O	O	O	O	O	Low power work

LED	Color	Descriptopn
DL1	Red	Power Supply +5V
DL2	Red	Power Supply +24V
DL3	Green	Enable to start motore
DL4	Yellow	Flag Sync - Home High
DL5	Yellow	Flag Home

All voltages are referred to GND - D = GND - A = TP1=TP2

DOCUMENTATION

EB0092.01.A.SC (electrical diagram)
17970/20 - 23.A.PM (assembly drawing)

8.4 Maintenance Control Motor Assembly

Remove the outside panels. (see " General Maintenance ")

8.4.1 DRIVER MODULE REPLACEMENT

1. Disconnect all the connectors from the driver modules P/N: 17970/20 - 23.
2. Remove the screws that hold the driver module,
3. Replace the board. (Do NOT invert the similar connectors, make reference to the colored label on the connector and the front panel).

! Replace the module with the same code as indicated in the front panel.

8.4.2 REPLACEMENT OF M/B CONTORL MOTOR BOARD

1. Disconnect connectors (J1, J2, J3, J4, J5 back view) from the M/B control motor board P/N: 17970/26 or 17970/26
2. Remove the fixing screws and replace the board.

8.5 Trouble Shooting Guide

Below are listed a number of symptoms and problems and how to solve them.
To solve some of the problems use the Diagnostic Program "**HumaStar 300 TOOLS**".

Defect	Causes and Remedies
Reagent Arm does NOT move.	- Check the start up voltage PWR ON of the Reagent System (see also „3.5 Trouble Shooting Guide".) - Check if red LED is ON (DL1) + 24V on the driver modules. - Check fuse F1 on modules **17970/20 - 23** - Check voltage +24V on J1 board **17970/26** - Replace damaged module **17970/20 - 23** - Replace the CPU slave board - Reagents **17970/8** - Replace Mother board **17970/26**
Sampling Arm does NOT move.	- Check the start up voltage PWR ON – Sampling System.(see also „3.5 Trouble Shooting Guide".) - Check if red LED is ON (DL1) + 24V on driver modules. - Check fuse F1 on modules **17970/20 - 23** - Check voltage +24V on J1 board **17970/26** - Replace damaged **17970/20 - 23** - Replace CPU slave board Sampling **17970/8** - Replace Mother board **17970/26**

Cuvette Washing Probe and cuvette plate do NOT move.	- Check the start up voltage PWR ON of the Cuvette measuring System. (see also „3.5 Trouble Shooting Guide“.) - Check if red LED is ON (DL1) + 24V on the driver modules - Check fuse F1 on modules **17970/20 - 23** - Check voltage +24V on J2 board **17970/26** - Check voltage +24V on J1 board **17970/26** - Replace damaged modules **17970/20 - 23** - Replace CPU slave board Cuvette System **17970/8** - Replace Mother board **17970/26** - Replace Mother board **17970/26**
Photometer Filter wheel does NOT move	- Check the start up voltage PWR ON of the measuring System. (see also „3.5 Trouble Shooting Guide“.) - Check if red LED is ON (DL1) + 24V on the driver modules - Check fuse F1 on module **17970/20** - Check voltage +24V on J2 board **17970/26** - Replace board EB0092.04 - Replace CPU slave board Cuvette System **17970/8** - Replace Mother board **17970/26** - Replace microcontroller U3 PD0042.01 on **17970/8** - Replace microcontroller U3 PD0044.01 on **17970/19**

To assure a rapid and efficient service to its clients, HUMAN suggests to keep in stock all the parts marked with (•). When ordering parts, make sure to mention the following: Code Number, Description and Quantity.

8.6 Spare Part List

Code	Sub_Code		Description	QTY
17970/26			Mother board control motor	1
17970/26			Mother board control motor	1
EB0092.02	17970/20	●	Driver motor (rotation Reagent Arm)	1
	17970/20		Driver motor (rotation Sampling Arm)	1
	17970/20		Driver motor (rotation Sample Plate)	1
	17970/20		Driver motor (rotation Cuvette Plate)	1
EB0092.03	17970/21	●	Driver motor (UP movement Sampling Probe)	1
	17970/21		Driver motor (UP movement Reagent Probe)	1
EB0092.04	17970/22	●	Driver motor (filter wheel)	1
EB0092.05	17970/23	●	Driver motor (UP movement Cuvette washing Probe)	1
EB0092.06	17970/24	●	Driver motor (rotation Reagent plate)	1
	680.020.216	●	Fuse F1-1,6°	1

8.7 Enclosed Documentation

8.7.1 17970/26.A.SC (ELECTRICAL DIAGRAM)

8.7.2 17970/26.A.PM (ASSEMBLY DRAWING)

8.7.3 17970/26.A.SC (ELECTICAL DIAGRAM)

8.7.4 17970/26.A.PM (ASSEMBLY DRAWING)

8.7.5 EB0092.01.A.SC (ELECTRICAL DIAGRAM)

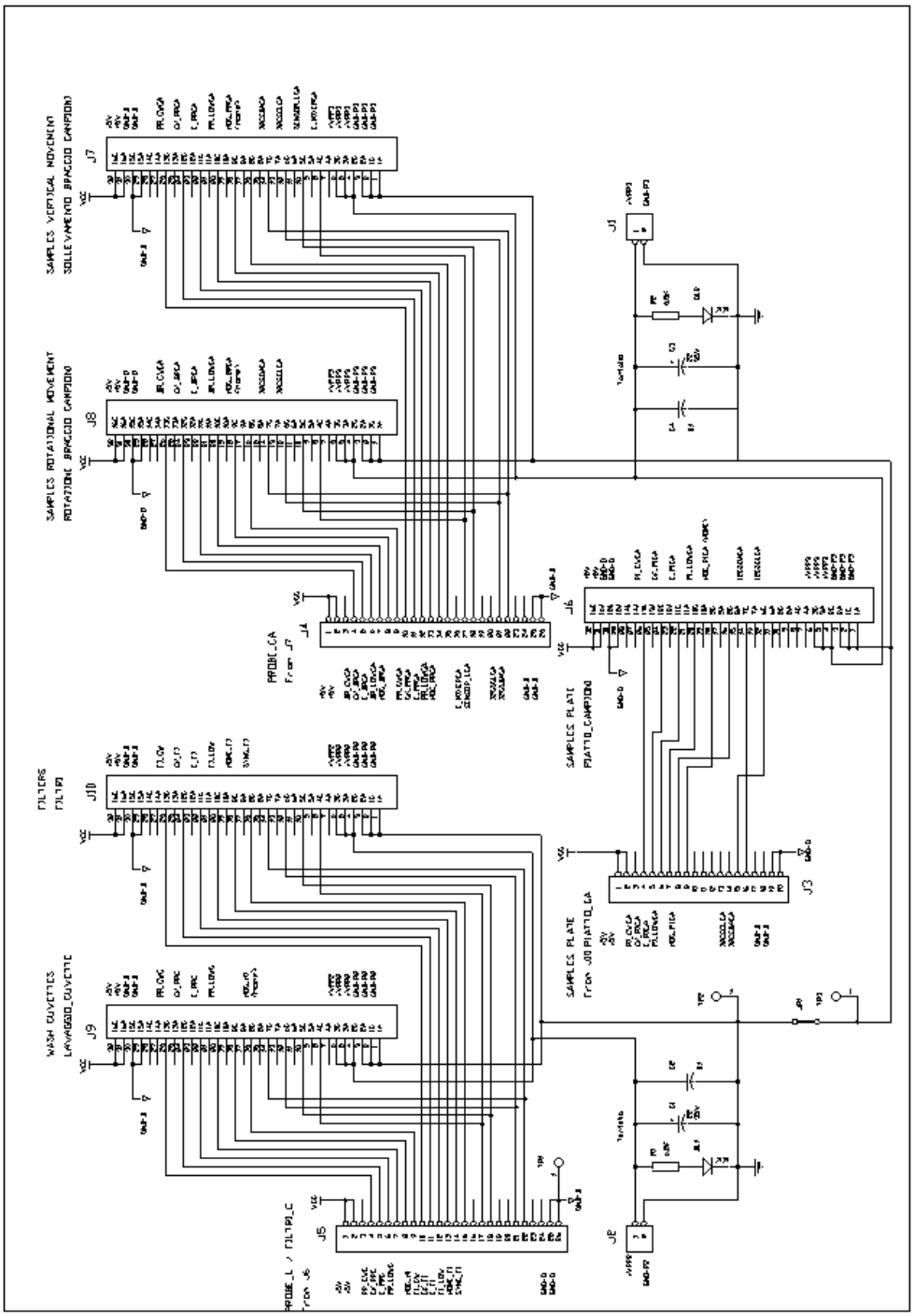
8.7.6 EB0092.02.A.PM (ASSEMBLY DRAWING)

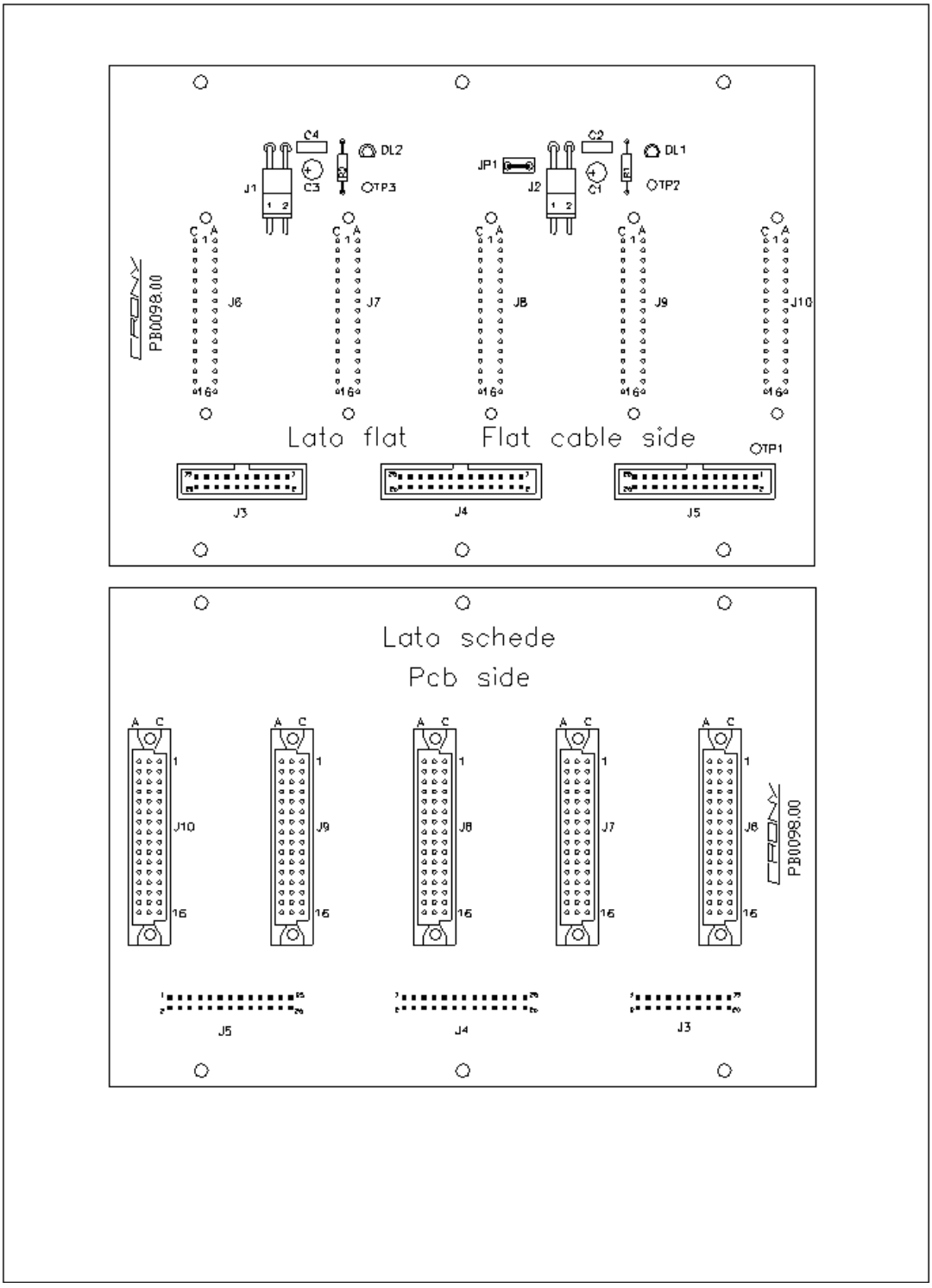
8.7.7 EB0092.03.A.PM (ASSEMBLY DRAWING)

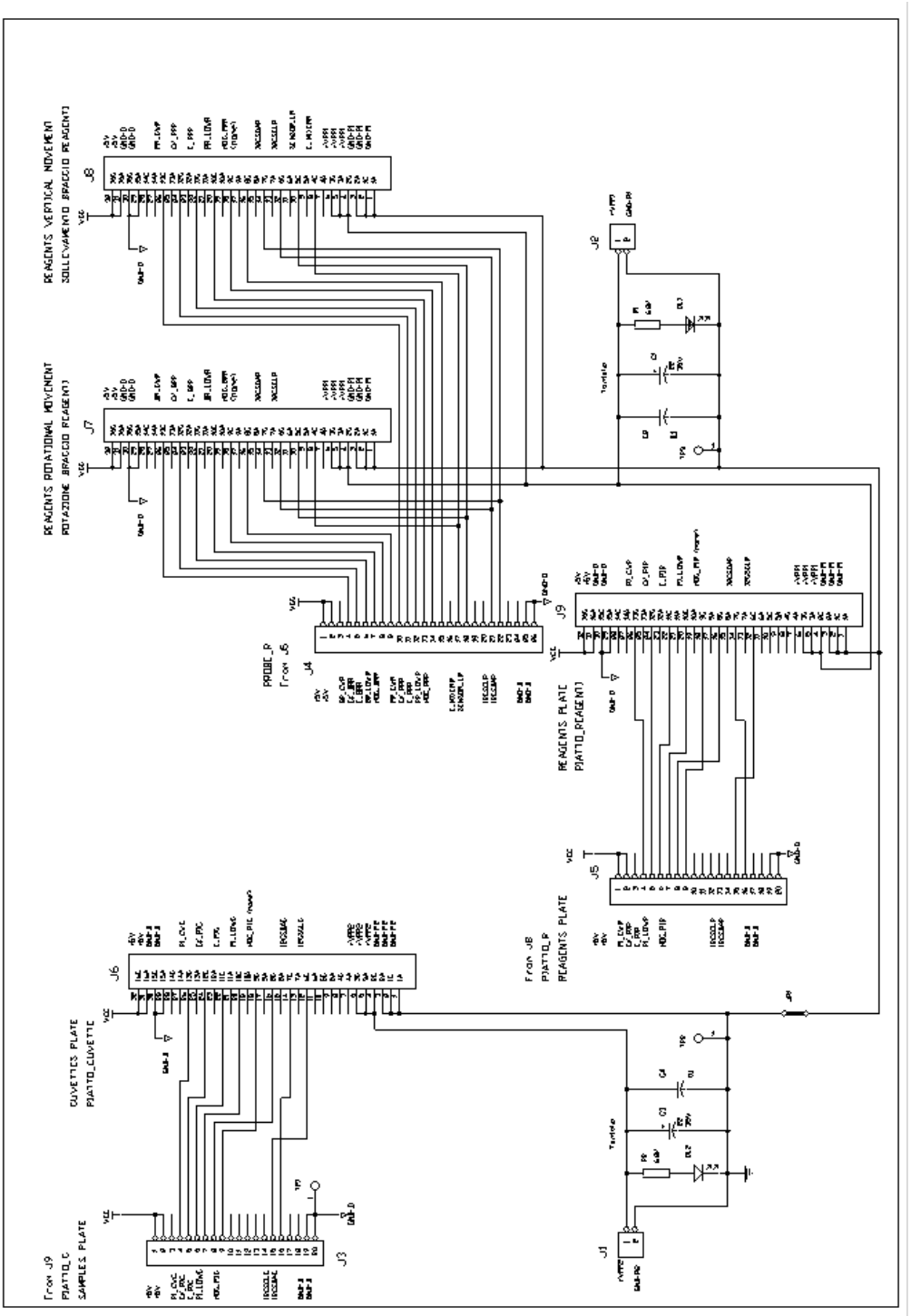
8.7.8 EB0092.04.A.PM (ASSEMBLY DRAWING)

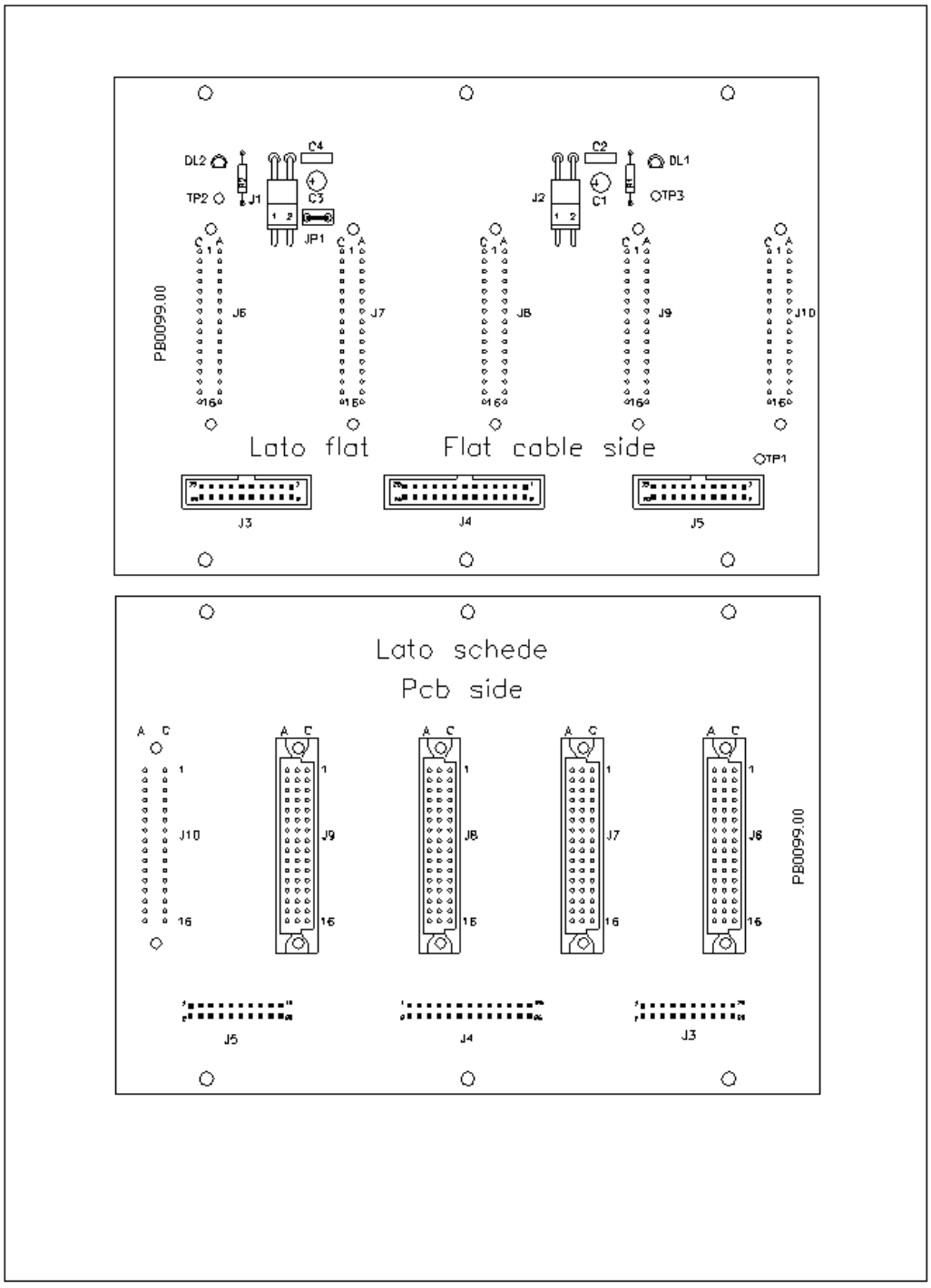
8.7.9 EB0092.05.A.PM (ASSEMBLY DRAWING)

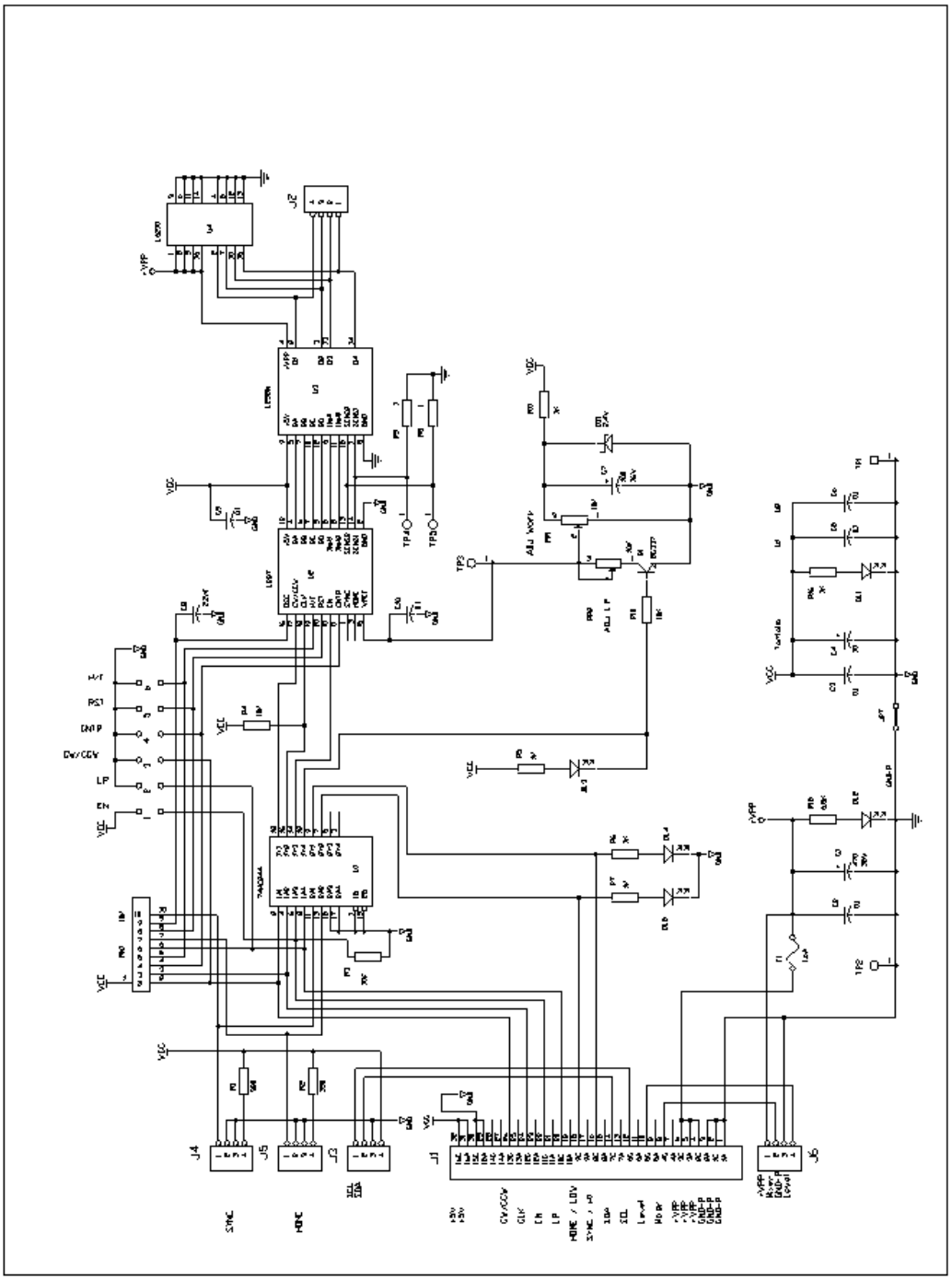
8.7.10 EB0092.06.A.PM (ASSEMBLY DRAWING)

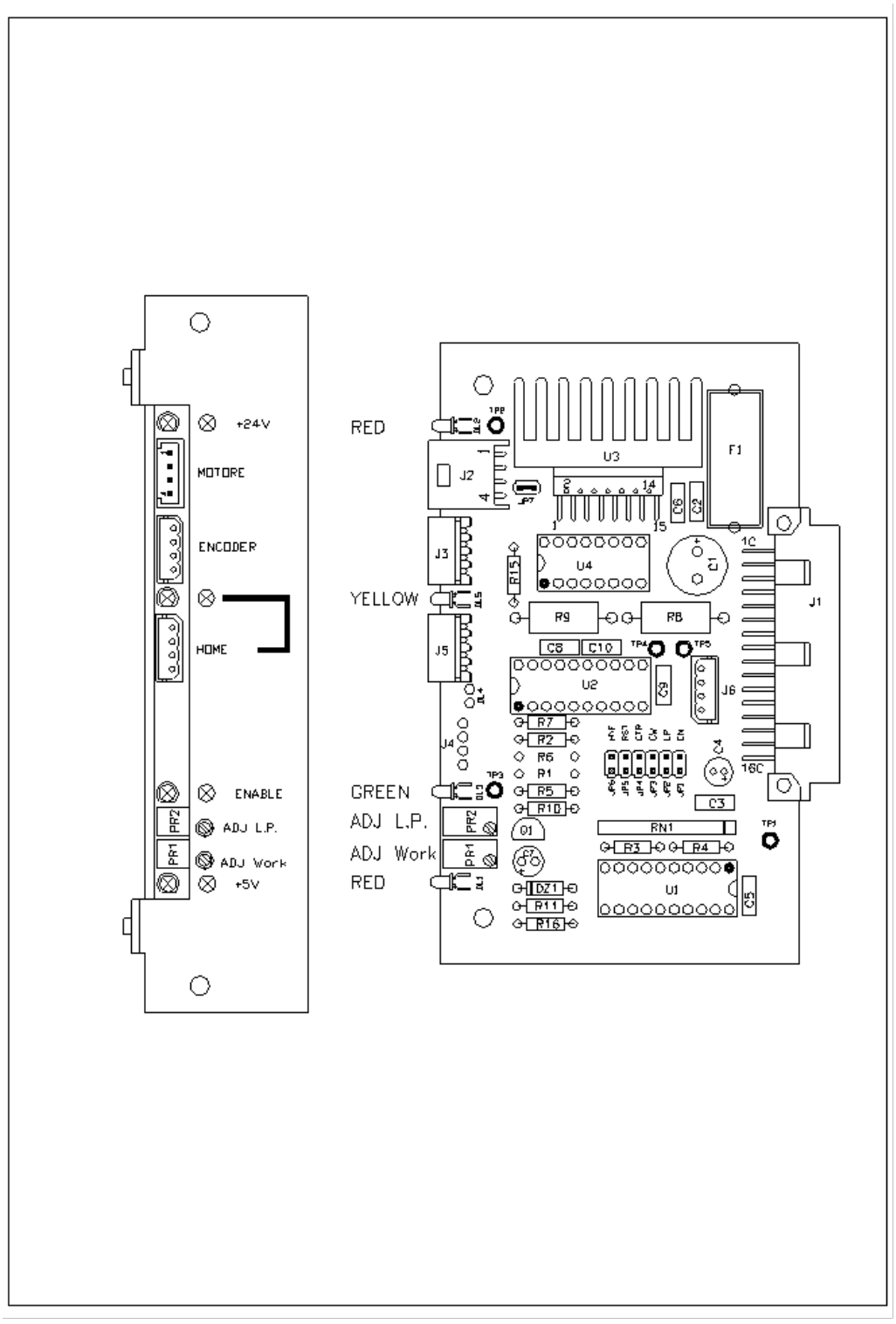


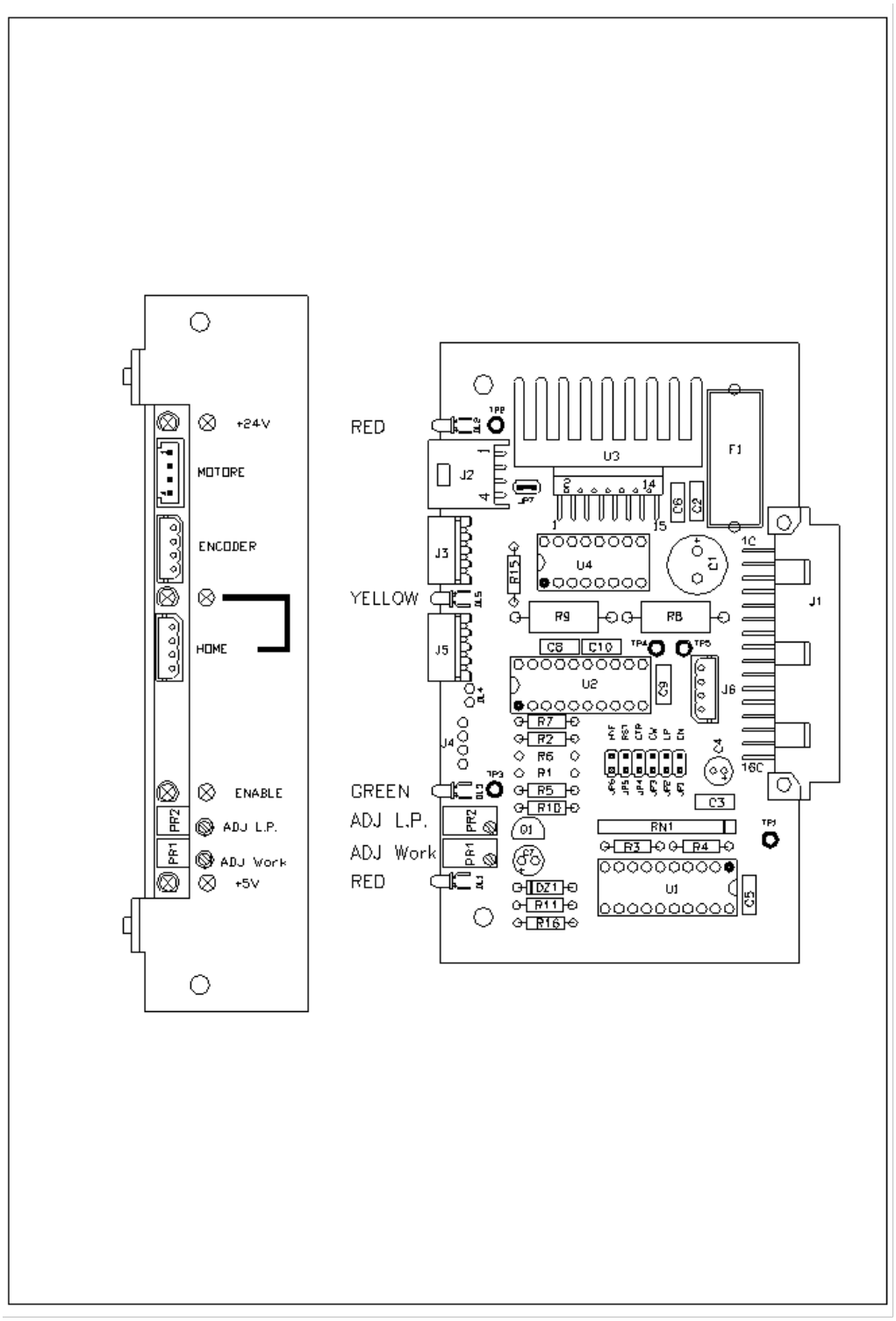

C4
DL2
J1
C3
TP3
JP1
C2
DL1
J2
C1
TP2
PB0098.00
J6
J7
J8
J9
J10
Lato flat
Flat cable side
TP1
J3
J4
J5
Lato schede
Pcb side
J10
J9
J8
J7
J6
PB0098.00
J5
J4
J3

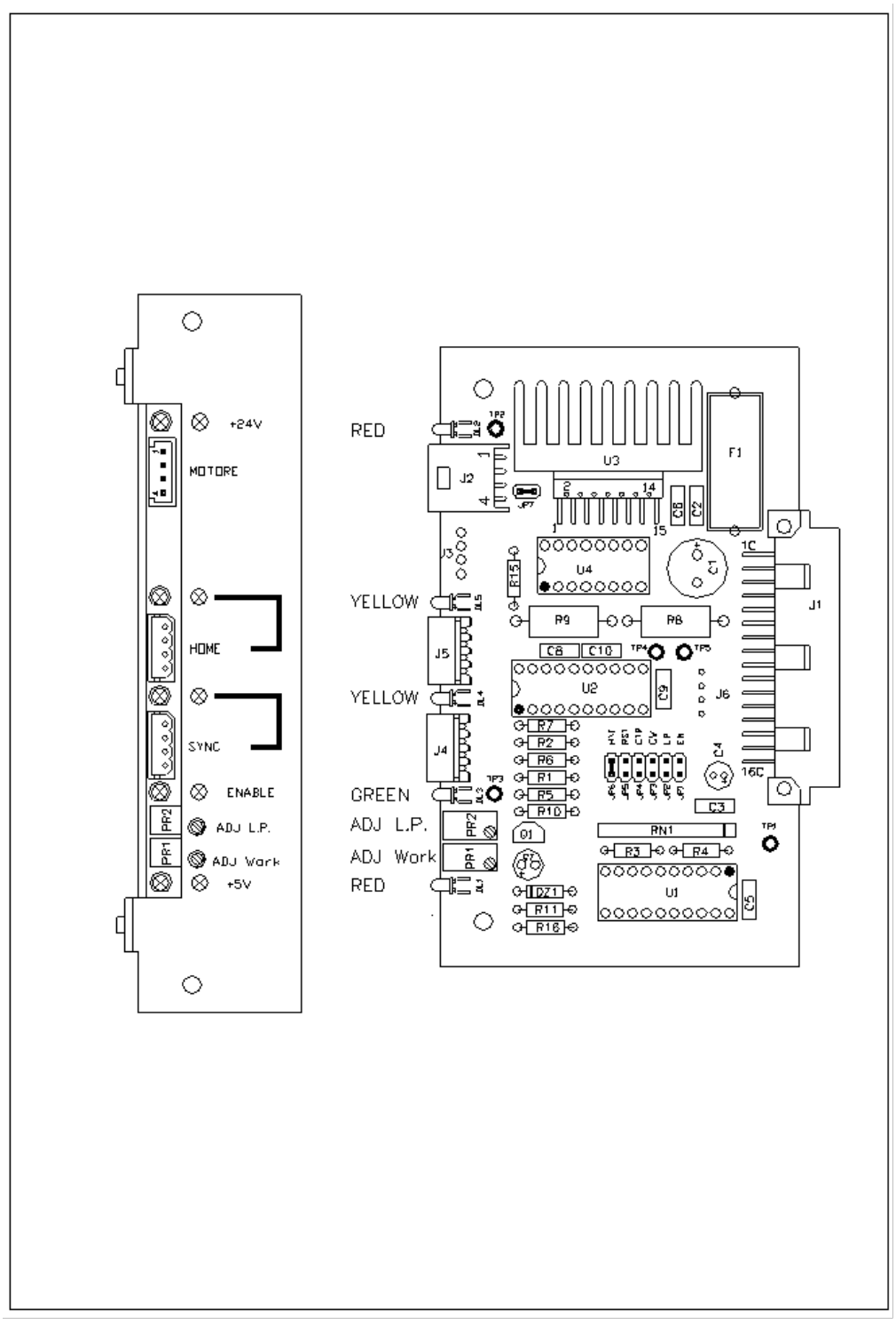


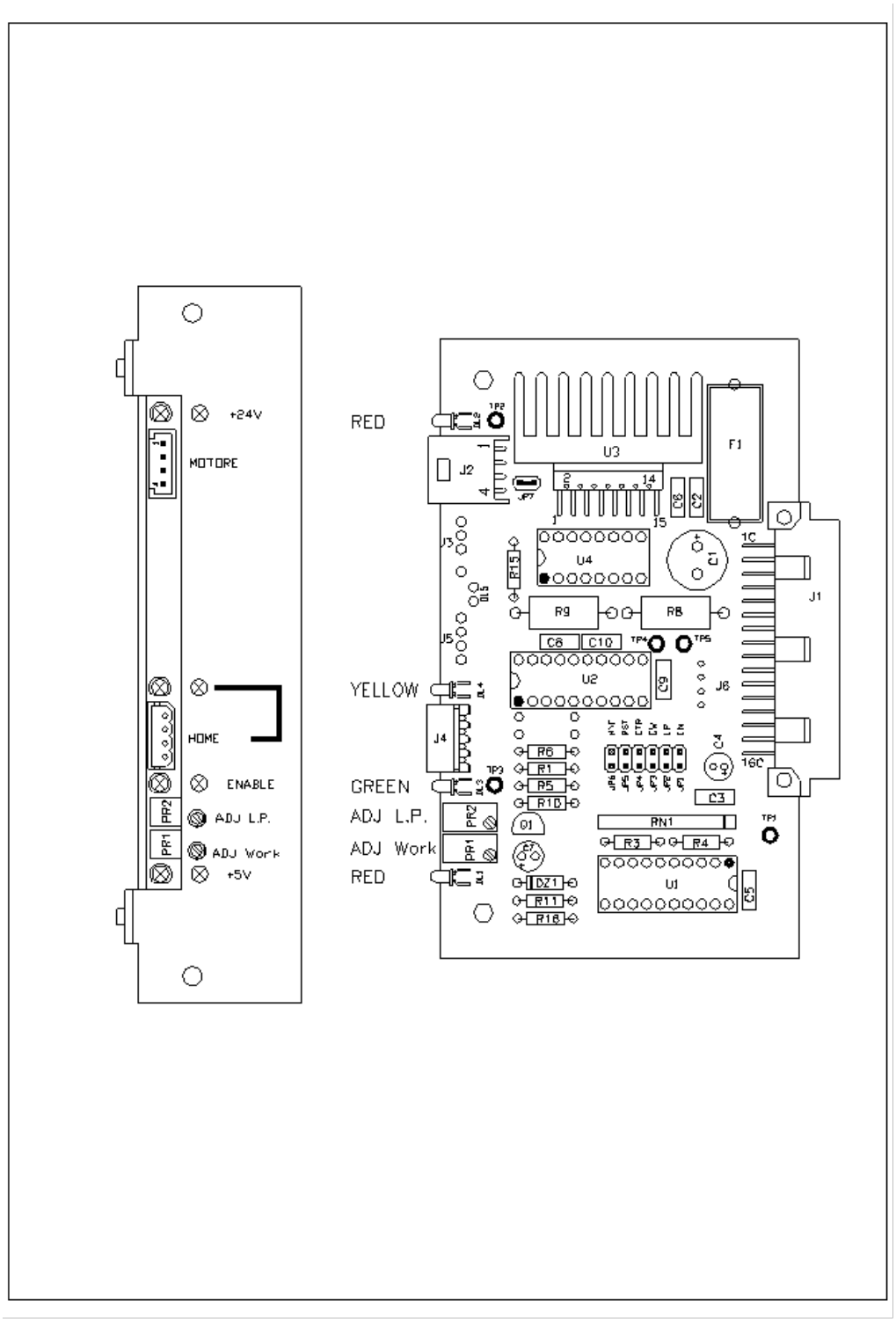

C4
DL2
TP2
J1
C3
JP1
C2
DL1
J2
C1
TP3
PB0099.00
J6
J7
J8
J9
J10
Lato flat
Flat cable side
TP1
J3
J4
J5
Lato schede
Pcb side
J10
J9
J8
J7
J6
PB0099.00
J5
J4
J3

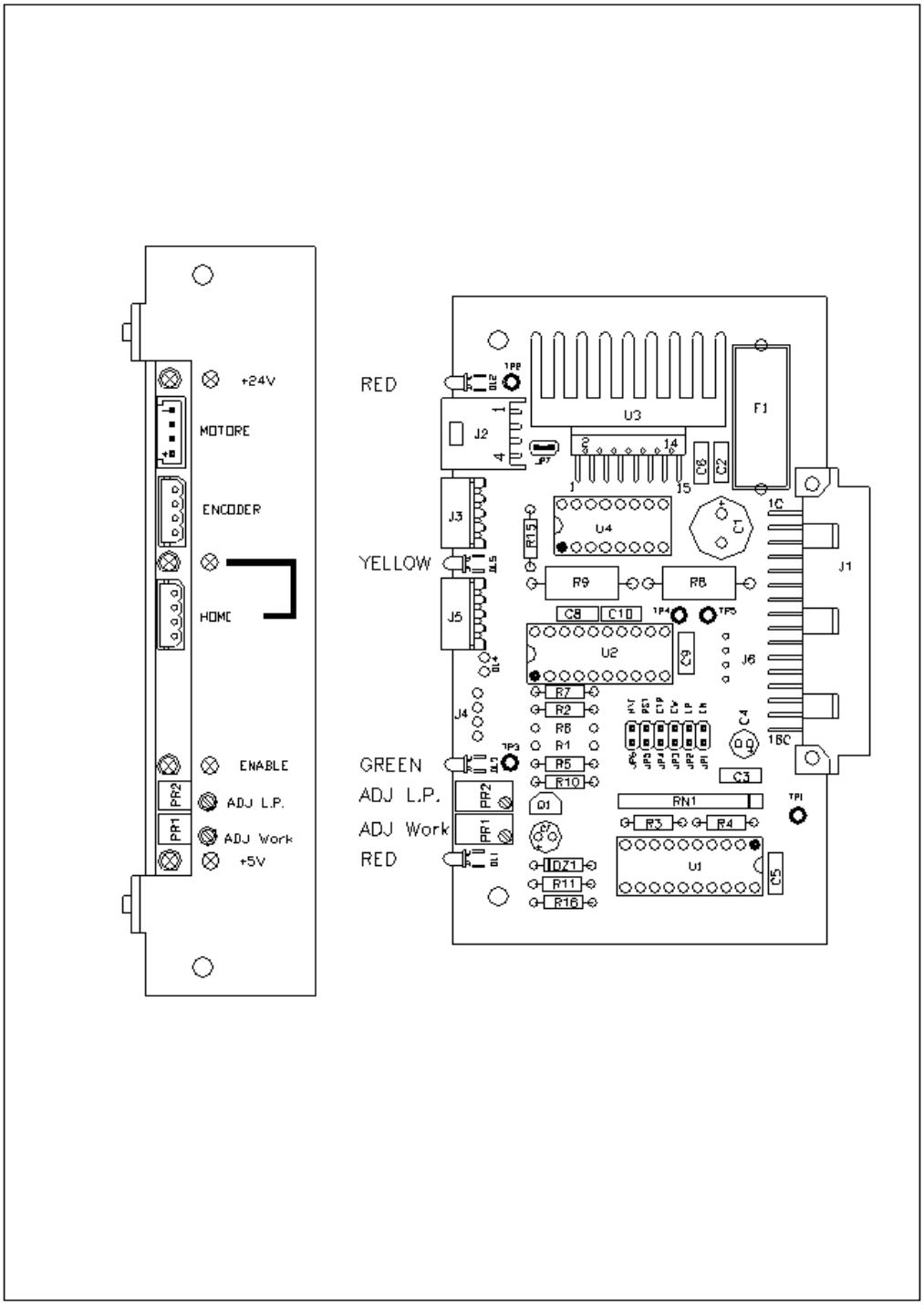



+24V
MOTORE
ENCODER
HOME
ENABLE
ADJ L.P.
ADJ Work
+5V
RED
YELLOW
GREEN
ADJ L.P.
ADJ Work
RED
U3
F1
U4
U2
U1
RN1
J1
J2
J3
J5
J6
C1
C2
C3
C4
C5
C6
C8
C9
C10
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R15
R16
DZ1
Q1
PR1
PR2


+24V
MOTORE
ENCODER
HOME
ENABLE
ADJ L.P.
ADJ Work
+5V
RED
YELLOW
GREEN
ADJ L.P.
ADJ Work
RED
U3
F1
U4
U2
U1
J1
J2
J3
J4
J5
J6
R7
R2
R6
R1
R5
R10
R9
R8
R15
R3
R4
RN1
C1
C3
C4
C5
C6
C8
C10
DZ1
R11
R16


+24V
MOTORE
HOME
SYNC
ENABLE
ADJ L.P.
ADJ Work
+5V
RED
YELLOW
YELLOW
GREEN
ADJ L.P.
ADJ Work
RED
U3
F1
U4
U2
U1
J1
J2
J3
J4
J5
J6
C1
C2
C3
C4
C5
C6
C8
C9
C10
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R15
R16
RN1
DZ1
PR1
PR2


+24V
MOTORE
HOME
ENABLE
ADJ L.P.
ADJ Work
+5V
PR1
PR2
RED
YELLOW
GREEN
ADJ L.P.
ADJ Work
RED
U3
F1
U4
U2
U1
J1
J2
J4
J5
J6
R6
R1
R5
R10
R15
R9
R8
C6
C10
C9
C1
C2
C3
C4
C5
RN1
R3
R4
DZ1
R11
R16
D1
TP1
TP2
TP3
TP4
TP5


+24V
MOTORE
ENCODER
HOME
ENABLE
ADJ L.P.
ADJ Work
+5V
RED
YELLOW
GREEN
ADJ L.P.
ADJ Work
RED
U3
F1
U4
U2
U1
J1
J2
J3
J4
J5
J6
R9
R8
R7
R2
R1
R5
R10
RN1
R3
R4
R11
R16
C1
C2
C3
C4
C5
C6
C8
C10
C9
D1
DZ1

9 DATA PROCESSING OF THE OPTICAL SIGNAL

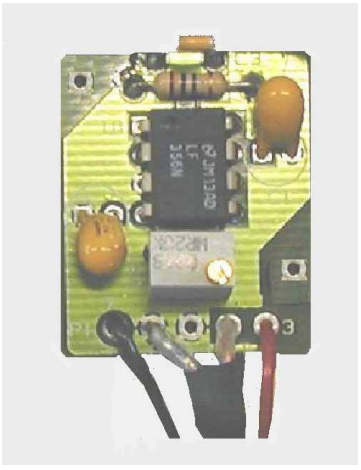
9.1 Preamplifier (P/N: 18720/8)

TECHNICAL DESCRIPTION (AY0041.02)

The monochromatic light from the photometer, passes through the quartz cuvette immerged in an incubation bath, hits the photosensitive detector (OD1), which in turn generates an output current proportional to the intensity of light received. The circuitry (U1) converts the current into voltage which is measured by the A/D converter.

- During operation it is necessary to obtain the maximum energy possible. To measure it – dispense 500 µl of dist. Water into the cuvette that sits in front of the photometer light source. Select filter 340 nm and measure on TP2 **17970/19** the voltage > 800 mV max 1400mV.
- To measure the (dark current), in complete absence of light, block completely the light to the photodiode detector and measure on TP2 **17970/19** a voltage of -15mV (adjust the off-set with PR1).

! The complete assembly Code is: 17970/90



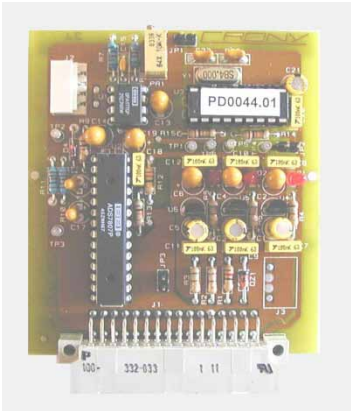
DOCUMENTATION

18720/8.A.SC	(electrical diagram)
18720/8.A.PM	(assembly drawing)

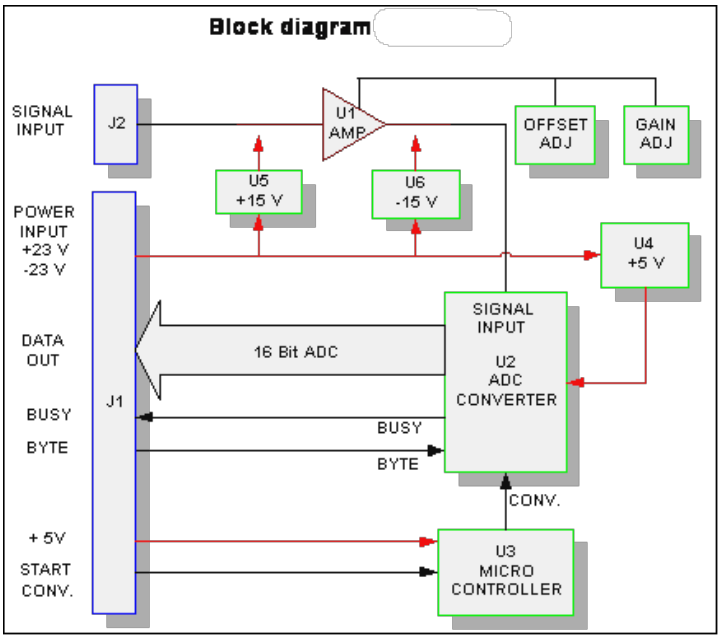
9.2 Converter A/D (P/N: 17970/19)

TECHNICAL DESCRIPTION

- The analogic signal that comes from the pre-amplifier (**18720/8**) enters the amplifier stage and further to the analog digital converter A/D to be measured. The A/D converter (U2), with a 16 bit resolution is controlled by a microprocessor (U3).
- The power supply voltages +15V and –15V are generated by the circuits U5 and U6.
- Adjust the off-set of the amplifier (U1) with trimmer PR2. The voltage on TP3 should be between -5mV and -15mV, when the input signal on TP2 is zero volt.



! With an input voltage on TP2 of 1 volt, the output voltage on TP3 should be 4,3 volt (adjust with PR1).



Ref.	Check Point	Range
1	TP4	+ 5 ± 0,2V
2	Pin 14 / U3	+ 5 ± 0,2V
3	TP5	+ 15 ± 0,25V
4	TP6	- 15 ± 0,25V

All voltages are referred to GND - D = GND - A = JP1

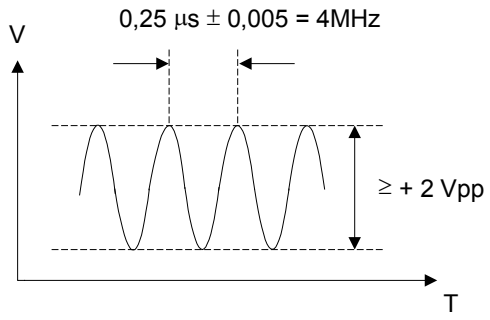


FIGURE 35
Clock signal, pin 15 U3

JP1	Closed (soldered)

FIGURE 36
Position jumpers

Board	Description	Device	Layo.Ref.	Software P/N
17970/19	ADC Conv.	PIC16F84A	U3	PD0044.01

FIGURE 37
List ofn programmed Devices

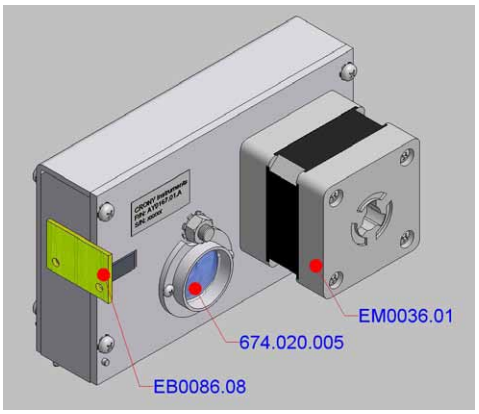
DOCUMENTATION

17970/19.A.SC (electrical diagram)
17970/19.B.PM (assembly drawing)

9.3 Photometer (P/N:17970/30)

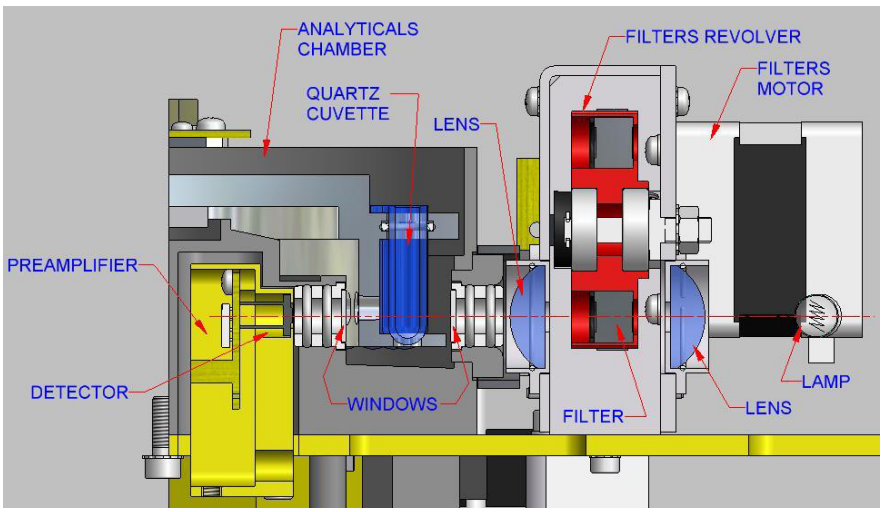
TECHNICAL DESCRIPTION

The HumaStar 300 photometer has eight narrow band interference filters inside a filter wheel. A halogen light source passes through the filters to produce a monochromatic light to measure the intensity of color of the reaction inside the quartz reaction cuvette.



The system is shown fig. 36, aligned on an optical axis. The light produced by the halogen lamp (UV NO STOP range from 340 to a 800nm) passes through an optical lens, and focused on the interference filter. The monochromatic light is focused on to the quartz measuring cuvette containing the liquid to be analyzed. The intensity of light is then measured by a solid state detector and converted into an analogical signal proportional to the intensity of light received. This signal is further converted into a digital result and processed by a µ-processor.

FIGURE 38



9.4 Maintenance

Remove the outside covers. (see instruction in „18 Maintenance“).

9.4.1 PHOTOMETER MODULE

The maintenance procedure for the Photometer Module, see „18.4 Photometer Module“.

9.4.2 REPLACEMENT OF THE PREAMPLIFIER

To replace the preamplifier board – see „18.4 Photometer Module“.

1. Disconnect connector J2 from board **17970/19** and remove cable, if necessary remove the Photometer module.
2. Remove the screws and take out the preamplifier board.
3. Replace the new preamplifier, making sure that the cable passes correctly through the cuvette reaction plate, and that the optical window of the detector is perfectly aligned and centered inside the hole.
4. Replace the Photometer if it was taken out, and reconnect the cable onto connector J2 of board **17970/19**.
5. Check the value of the output signal from the preamplifier, it should be within the specifications.

! This operation should be done with analyzer turned OFF.

9.5 Trouble Shooting Guide

This section lists some of the symptoms and problems and how to solve them. For some of the problems use the Diagnostic Program of "**HumaStar 300 TOOLS**".

Defect	Causes and Remedies
The output signal coming from the pre-amplifier is out specs. (< 0,8 V)	- Change the liquid (**plain bi-distilled water**) in the incubation bath. - Clean all the cuvettes with Extran or any other Neutral detergent used for glassware in the laboratory. - Select the second lamp. If necessary change both lamps and realign them properly. - Execute a HOME position for the cuvette reaction plate. - Make sure that cuvette 38 is in front of the photometer light, pipette into it 500 µl of bi-distilled water. - Check voltage on TP2 board **17970/19**. Its acceptable range is > = **0,8V < 1,4V** - Check voltage of the lamp, it should be from +11V to a Max of +11,5V. - Check TP15 (+ 15V) and TP6 (– 15V) on board **17970/19**, if necessary replace the board. - Select another cuvette and fill it with 500 µl of bi-dist. Water and repeat the measurement on TP2 - Replace the pre-amplifier board.
Output signal from the pre-amplifier does not chaznge, it remains fixed on a given value	- Missing power of ± 15V - Check fuse F7 and F8 board 17970/7 - Check on TP15 (+ 15V) and TP6 (– 15V) board **17970/19**, if necessary replace it. - Connection to GND is missing, replace the pre-amplifier board 18720/8

The output signal from the pre-amplifier is NOT stable.	- Photometer lamp is about to burn out- change lamp. - Check the stability of the lamp voltage of +11V - Check the stability of the power supply on TP15 (+ 15V) and TP6 (– 15V) board **17970/19** - Replace the pre-amplifier board. - False contact or an oxidized connection between the lamp connector and the power supply board 17970/10. Clean with alcohol and if necessary replace it. - A leak in the quartz window inside the incubation bath. Replace it and make sure there are no leaks.
Absorbance measurement using the Diagnostic program varies within ± 2 mAbs (out of range)	- Repeat the checks as above - Execute a [**Water blank**] using filter 340 nm (filter 1) - Select the box [ ] to measure Absorbance continuously at 340 nm - Click on [**Read One**] to start the measurement. Make sure that the Absorbance measurement is within the specified range of ± **2 mAb**s - Replace photometer lamp - Align Home + Sync of the Photometer - Replace board **17970/19**
The operating program signals "FATAL ERROR..." after having given an intermittent acoustic (beep). Probable Cause: missing SYNC signal from Photometer module.	- Check the start up PWR ON voltage of the Cuvette System. (See also „3.5 Trouble Shooting Guide".) - Activate rotation of the **filter wheel** and check the ON/OFF of the LED SYNC on driver 17970/23 - Make a mechanical alignment of the HOME signal and the SYNC of the Photometer. - Check the variation from 0V to 5V on pin 3 of U3 17970/8 - Replace the Opto Sync 17970/13 - Replace board 14970/23 - Replace U3 – 17970/8

During operation program signals " FATAL ERROR.." after having given an intermittent acoustic beep. **Probable cause:** **missing signal HOME from Photometer module.**	- Check the start up PWR ON voltage of the Cuvette System. (See also „3.5 Trouble Shooting Guide".) - Activate rotation of the **filter wheel** and check the ON/OFF of the LED HOME on driver 17970/23 - Make a mechanical alignment of the HOME signal and the SYNC of the Photometer. - Check the variation from 0V to 5V on pin 6 of U3 EB0046.01 - Replace opto Home 17970/14 - Replace board 17970/23 - Replace U3 – 17970/8
During operation program signals " FATAL ERROR.." after having given an intermittent acoustic beep. **Probable cause:** **The photometer filter wheel does NOT turn**	- Check the start up PWR ON voltage of the Cuvette System. (See also „3.5 Trouble Shooting Guide". - Make sure that the LED +24V is ON on module 17970/23 - Missing jumper on JP6 on board 17970/23 - Make a mechanical alignment of the HOME signal and the SYNC of the Photometer - Replace board 17970/23 - Replace the CPU slave board Cuvette System 17970/8

9.6 Spare Part List

Code	Sub_Code		Description	QTY
17970/30			Photometer Assembly	1
	EM0036.01		Motor	1
	MA0149.01		Complete Filter wheel assembly	1
	EB0086.07		Opto Sync	1
	EB0086.08		Opto Home	1
	674.020.005		Lens	3
	MS0840.01		Disc Sync	1
	218.152.092		Belt	1
17970/90			Preamplifier assembly	1
	18720/8	●	Preamplifier board with photodiode	1
	506.120.021		Photodiode	1
17970/19			A/D Converter	1
	PD0044.01		Programmed Device	1

! To assure a rapid and efficient service to the clients, HUMAN suggests to keep in stock all the parts marked with (•). When ordering make sure to give the following information: Code Number, Description and Quantity.

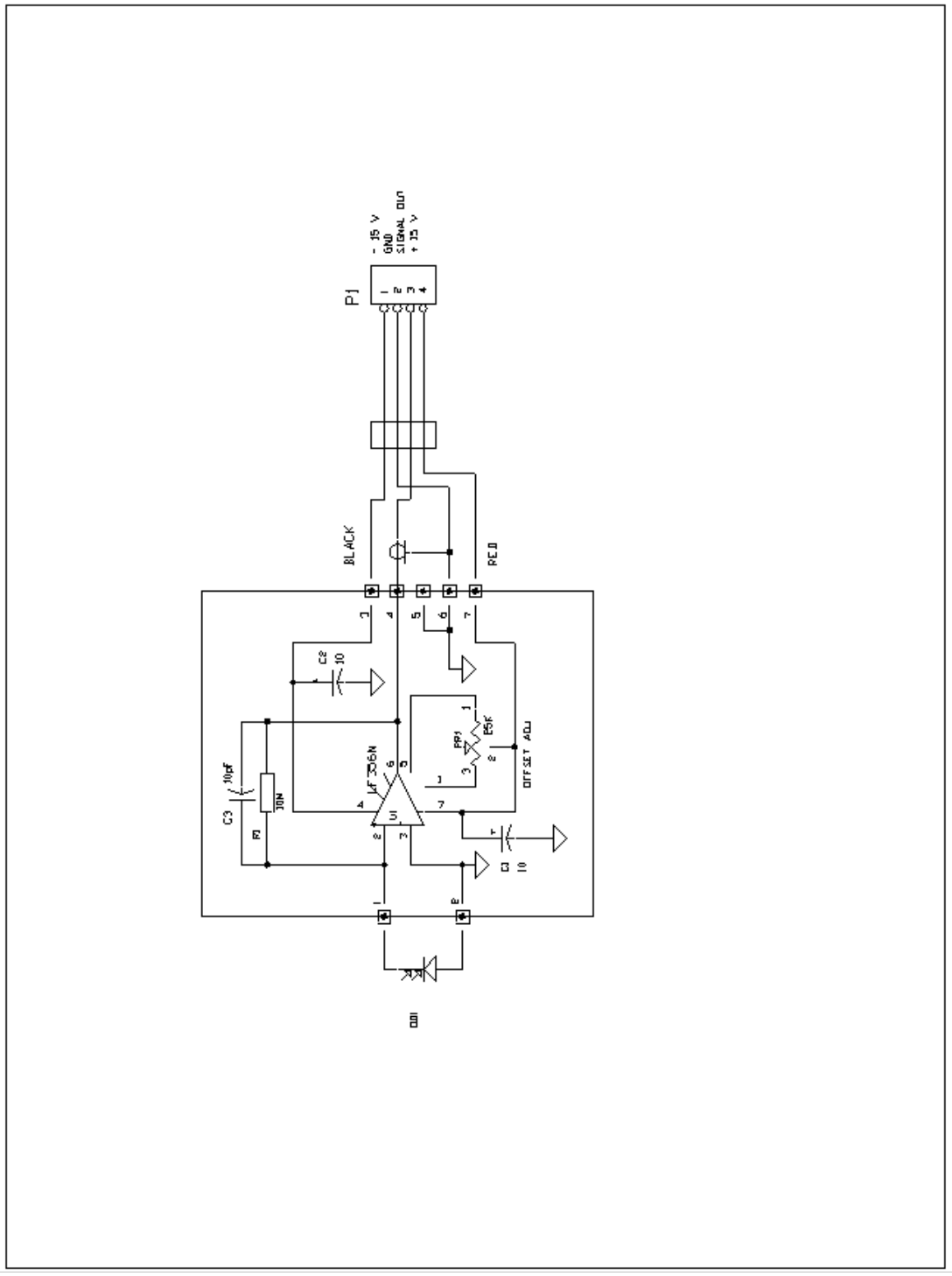
9.7 Enclosed Documentation

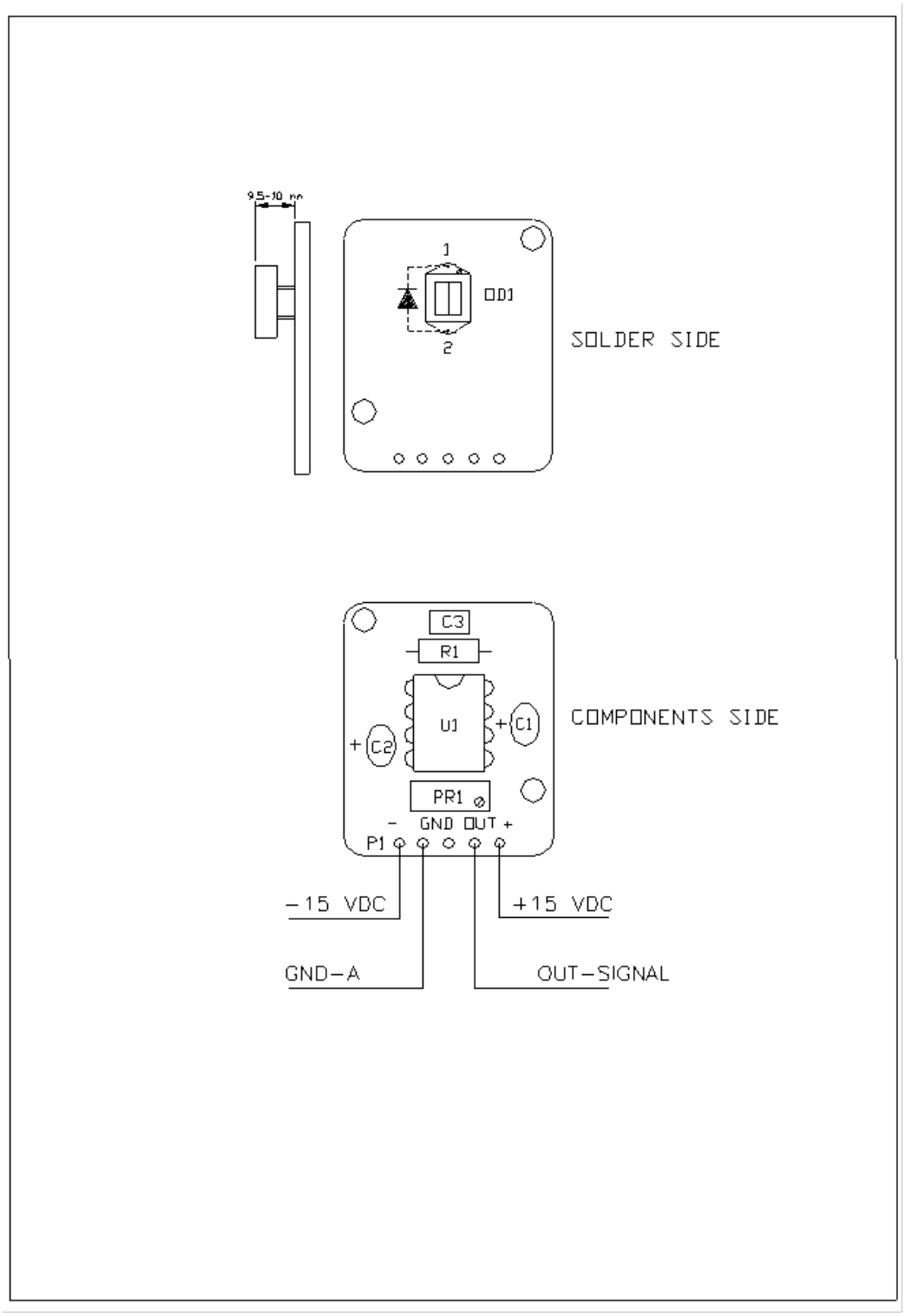
9.7.1 18720/8.A.SC (ELECTRICAL DIAGRAM)

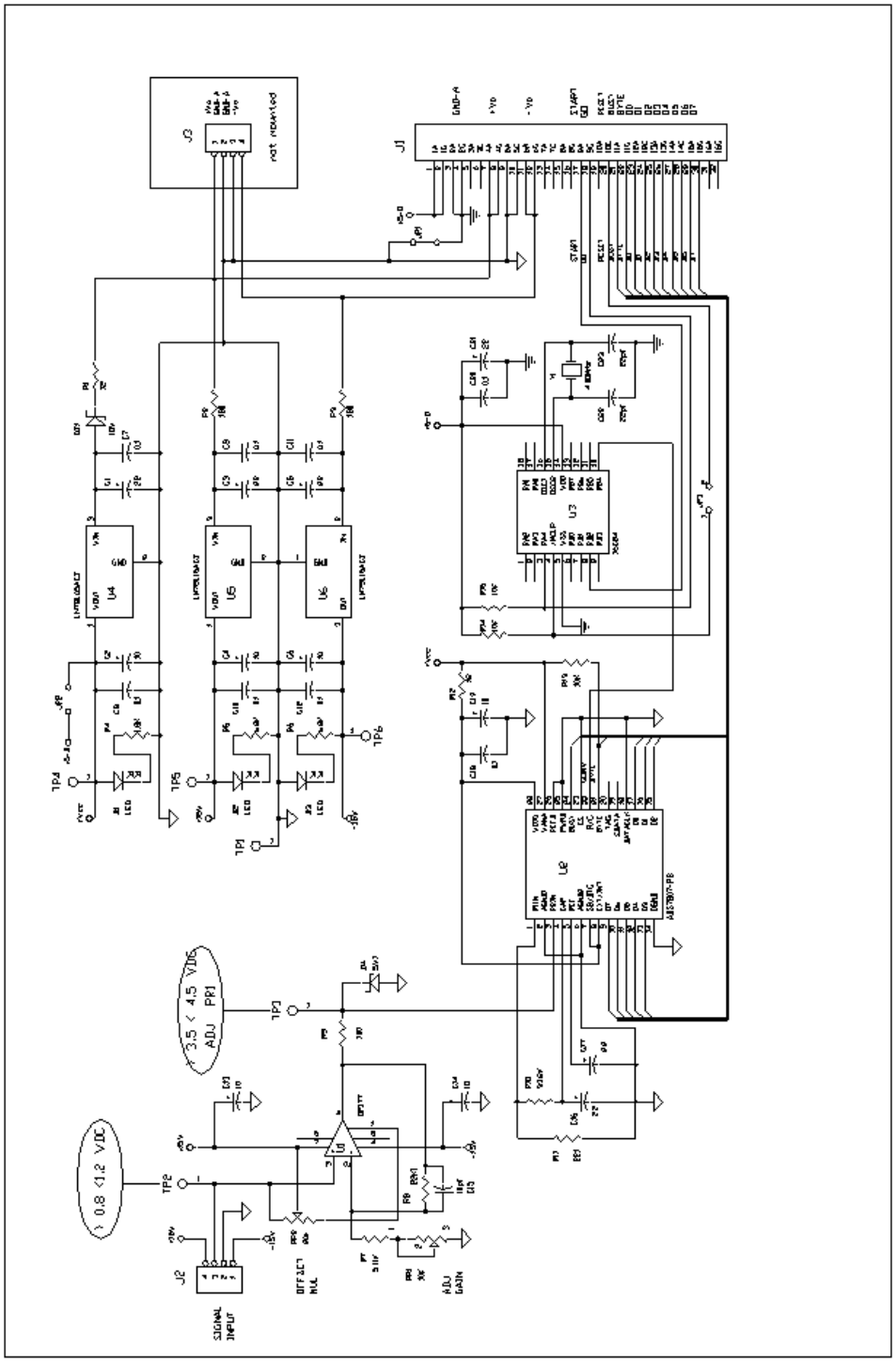
9.7.2 18720/8.A.PM (ASSEMBLY DRAWING)

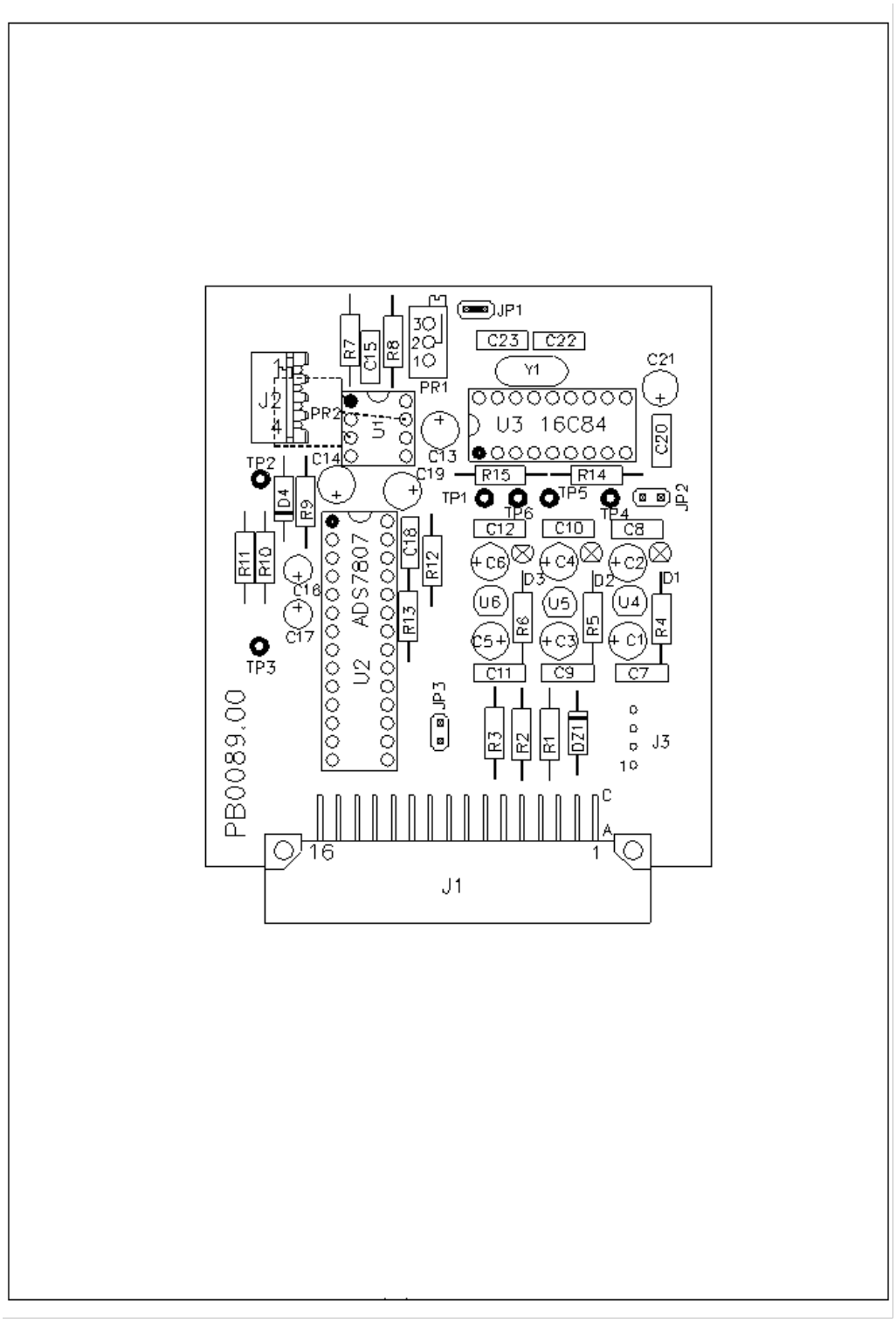
9.7.3 17970/19.A.SC (ELECTRICAL DIAGRAM)

9.7.4 17970/19.B.PM (ASSEMBLY DRAWING)


- 15 V
GND
SIGNAL OUT
+ 15 V
P1
BLACK
RED
C2
10
10pF
C3
R3
100K
U1
OFFSET ADJ
C1
10
D1


9.5-10 mm
1
DD1
2
SOLDER SIDE
C3
R1
U1
C1
C2
PR1
- GND OUT +
P1
-15 VDC
+15 VDC
GND-A
OUT-SIGNAL
COMPONENTS SIDE



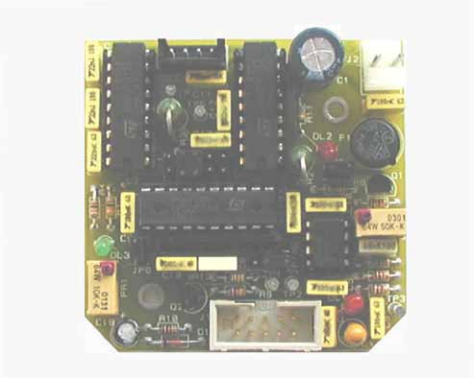

JP1
C23
C22
Y1
C21
R7
C15
R8
PR1
J2
PR2
U1
U3 16C84
C20
C13
C14
C19
R15
R14
TP2
D4
R9
TP1
TP6
TP5
TP4
JP2
C12
C10
C8
R11
R10
C16
C18
R12
U2 ADS7807
C6
C4
C2
D3
D2
D1
U6
U5
U4
R6
R5
R4
C17
C5
C3
C1
TP3
C11
C9
C7
JP3
R3
R2
R1
DZ1
J3
PB0089.00
C
A
16
1
J1

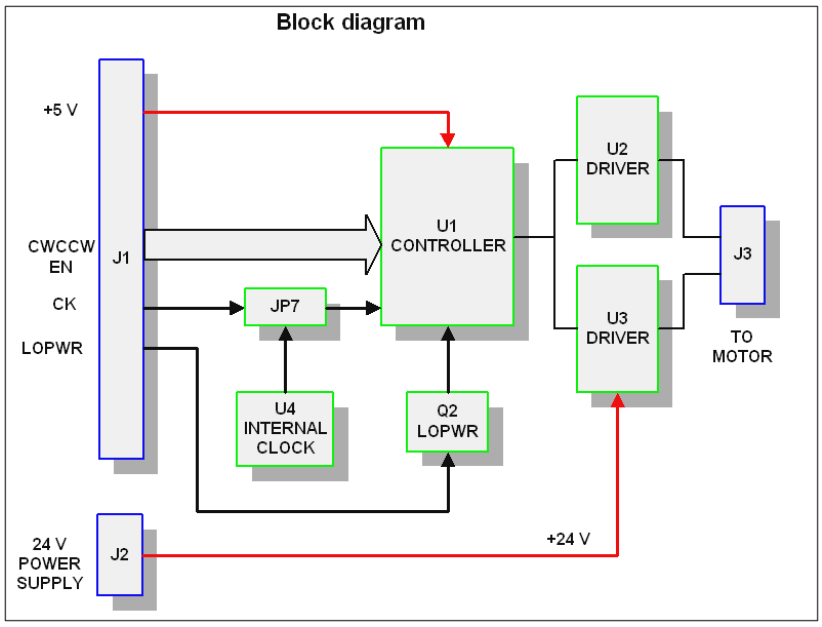
10 PERSISTALTIC PUMP DRIVER (P/N: EB0033.XX)

TECHNICAL DESCRIPTION

Function of the board:

- To control the stepper motor
- To vary the speed of the motor
- To keep the motor under charge during standby



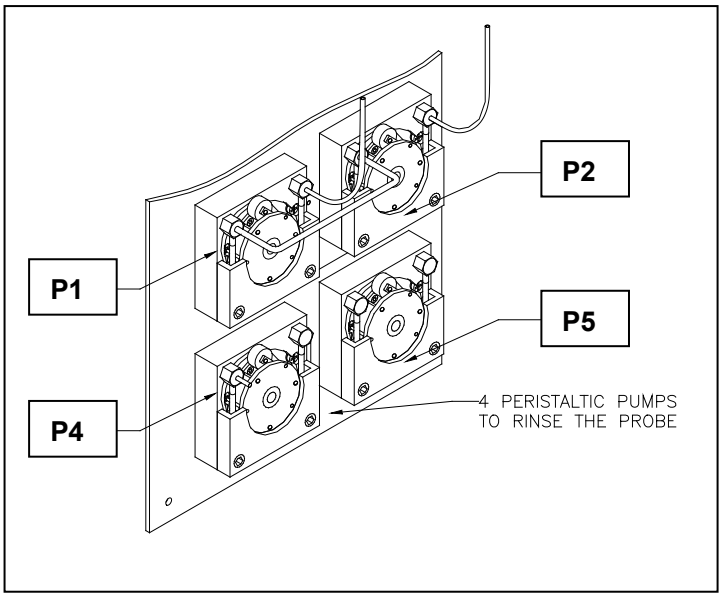


DO NOT change the positions of the jumpers.

Configuration of the hardware

Table 9 indicates for each board, the calibration voltages and position of the jumpers.

The figure below shows the disposition of the pumps inside the analyzer.



Documentation

To avoid malfunction, do NOT change the positions of these pumps. When changing a pump or a PCB make sure to it has exactly the same identification number indicated on the on the board or on the pump assembly.

POMPA	Version	Disegno	Description
P1 / P2	EB0033.03	EB0033.03.A.SC	(electrical diagram)
		EB0033.03.0.PM	(assembly drawing)
P4	EB0033.02	EB0033.02.0.SC	(electrical diagram)
		EB0033.01.A.PM	(assembly drawing)
P5	EB0033.01	EB0033.01.A.SC	(electrical diagram)
		EB0033.01.A.PM	(assembly drawing)

TABLE 10

Version	Range (mV)	Current (A)	Adj.	Clock (ms)	Adj.	Position of jumpers JPX O=Open, C=Closed								Description
	TP1			TP2		1	2	3	4	5	6	7	8	
EB0033.01	500± 20	0,5	PR1	1,7 >1, 6<1, 8 600Hz (*)	PR2	O	C	C	O	O	C	1-2	C	Pump P5
EB0033.02	500 ± 20	0,5	PR1	1 >0,95<1,05 1000Hz	PR2	O	C	C	O	O	C	1-2	C	Pump P4
EB0033.03	1000 ± 20	1	PR1	EXT	PR2	O	C	C	O	O	O	2-3	C	Pump P1-P2
LED	**Colore**													
DL1	Red													+5 V power supply
DL2	Red													+24 V power supply
DL3	Green													Enable

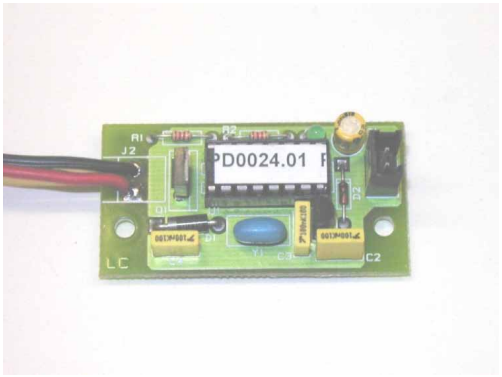
(*)**Note:** Procedure to calibrate pump volume of **P5** (cuvette wash).
After having adjusted the frequency as shown in Table 9 (1,7 ms), Check pump volume. It should pump 50ml of dist. Water in 90 seconds ± 2sec, if necessary adjust with PR2.

10.1 Linear Pump Driver (P/N:EB0122.01)

TECHNICAL DESCRIPTION

The function of this board is to generate a square wave of 50 Hz to excite the magnet of the linear pump P6.

The quartz Y1 generates the clock of the µcontroller (U1) which via Q1 controls the pump P6.



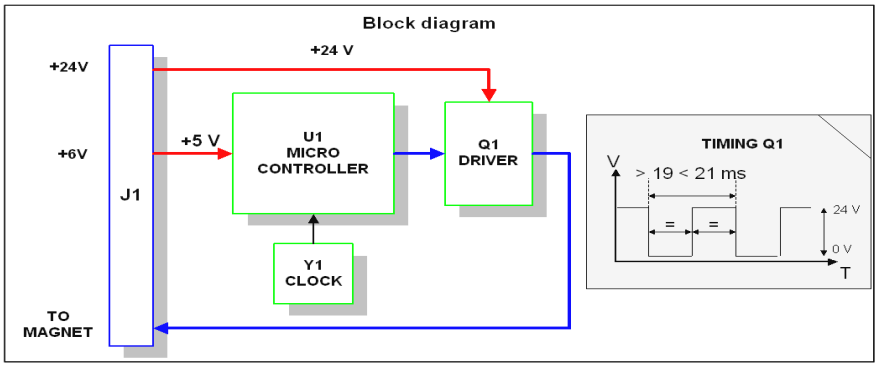


TABLE 11
List of programmable devices

Board	Description	Device	Layo.Ref.	Software P/N
EB0122.01	Driver pump	COP8SAA716	U1	PD0024.01

DOCUMENTATION

EB0122.01.0.SC (electrical diagram)
EB0122.01.0.PM (assembly drawing)

10.2 Maintenance

Remove the outside panes (See „18 Maintenance“)

Operation to be done with analyzer turned OFF.

The replacement procedure for all four pumps is exactly the same. For the specific maintenance of the peristaltic pumps, see Section 14.

Make sure to substitute the pumps with exactly the same type and Code.

10.2.1 REPLACEMENT PERISTALTIC PUMP DRIVER BOARD

The rotation of all the pumps is anticlockwise.

1. Empty the tubing and then remove it.
2. Remove the holding screws, disconnect the connectors and take out the pump. i.
3. Remove the two nuts and replace the pump.
4. Reassemble the pump following the block diagram to identify the correct connectors for both power supply and the signals.

10.2.2 REPLACEMENT OF THE LINEAR PUMP DRIVER BOARD P6

1. Remove the power connector from the board, the terminals from the pump and then remove the screws.
2. Replace the driver board and reassemble following the reverse sequence. Make sure that the connections "fasten type" are well inserted, the **Black** cord should be inserted into the terminal of the pump (on the V4 side), and the **red** cord into the terminal of the thermic switch (side of V5).

! Operation to be done with analyzer turned OFF.

! For the specific maintenance of the linear pump, see Section 15.

10.3 Trouble Shooting Guide

This section lists a series of symptoms or problems and how to solve them.
To solve some of these problems us the Diagnostic Program "**HUMASTAR 300 TOOLS**".

Defect	Causes and Remedies
Pump P1 does NOT start.	- Check the start up PWR ON voltage of the Sampling System (see also „3.5 Trouble Shooting Guide".) - Check fuse F1 on board EB0033.03 - Execute all the following Home positions: HOME Z; HOME ARM; HOME PLATE; HOME DILUTER, and the Sampling Probe should be in position WASH - Replace bpard EB0033.03 - Check and if necessary replace board **18720/24** - Check and if necessary replace the CPU slave board Sampling System **18720/8**
Pump P2 does NOT start.	- Check the start up PWR ON voltage of the Reagent System (see also „3.5 Trouble Shooting Guide".) - Check fuse F1 on board EB0033.03 - Execute all the following Home positions: HOME Z; HOME ARM; HOME PLATE; HOME DILUTER, and Reagent Probe should be in position WASH - Replace bpard EB0033.03 - Check and if necessary replace board **18720/24** - Check and if necessary replace the CPU slave board Reagent System **18720/8**

Pump P4 does NOT start.	- Check the start up PWR ON voltage of the Sampling and Reagent Systems (see also „3.5 Trouble Shooting Guide“.) - Check fuse F1 on board EB0033.02 - Replace board EB0033.02 - Check and if necessary replace board **18720/24** - Check and if necessary replace the CPU slave board of the Sampling System **18720/8**
Pump P5 does NOT start.	- Check the start up PWR ON voltage of the Cuvette-reaction system (see also „3.5 Trouble Shooting Guide“.) - Check fuse F1 on board EB0033.01 - Replace board EB0033.01 - Check and if necessary replace board **18720/24** - Check and if necessary replace the CPU slave board Cuvette-Reaction System **18720/8**
Pump P6 does NOT start.	- Check the start up PWR ON voltage of the Cuvette-reaction system (see also „3.5 Trouble Shooting Guide“.) - Check fuse F1 on board EB0033.01 - Replace board EB0033.01 - Replace U2 on board **18720/24** or if necessary replace the board. - Remove pump 6, open it and clean it internally. - If P6 does NOT work, check the continuity of the winding (The winding has a diode in series). - Check the continuity of the of the thermic switch. - Replace board EB0122.01 - Replace the CPU slave board of the Cuvette-Reaction System **18720/8**

10.4 Spare Part List

Code	Sub_Code		Description	QTY
EB0033.01		●	Driver board pump P5	1
EB0033.02		●	Driver board pump P4	1
EB0033.03		●	Driver Board pump P1 - P2	2
	680.015.216	●	Fuse F1-1,6A	1
EB0122.01		●	Driver board pump P6	1
	PD0024.01	●	Programmed Device	1

! To assure a rapid and efficient service to ones clients, HUMAN suggests to keep in stock the parts marked with (•). When ordering parts, please give the following information: Code Number, Description and Quantity.

10.5 Eclosed Documentation

10.5.1 8EB0033.01.A.SC (ELECTRICAL DIAGRAM)

10.5.2 EB0033.01.A.PM (ASSEMBLY DRAWING)

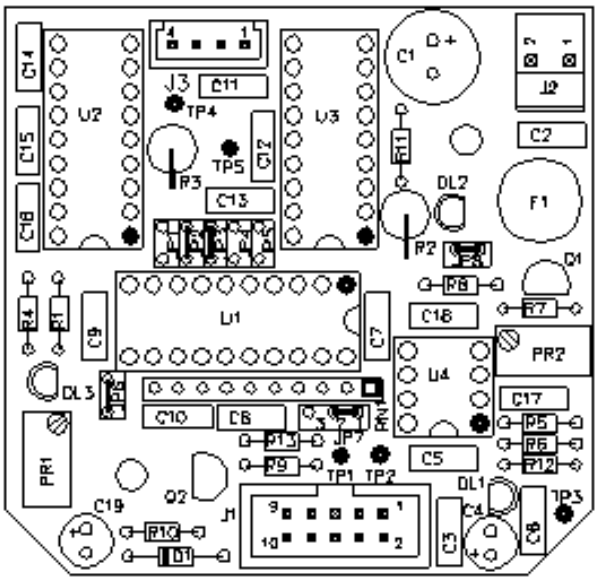
10.5.3 EB0033.02.A.SC (ELECTRICAL DIAGRAM)

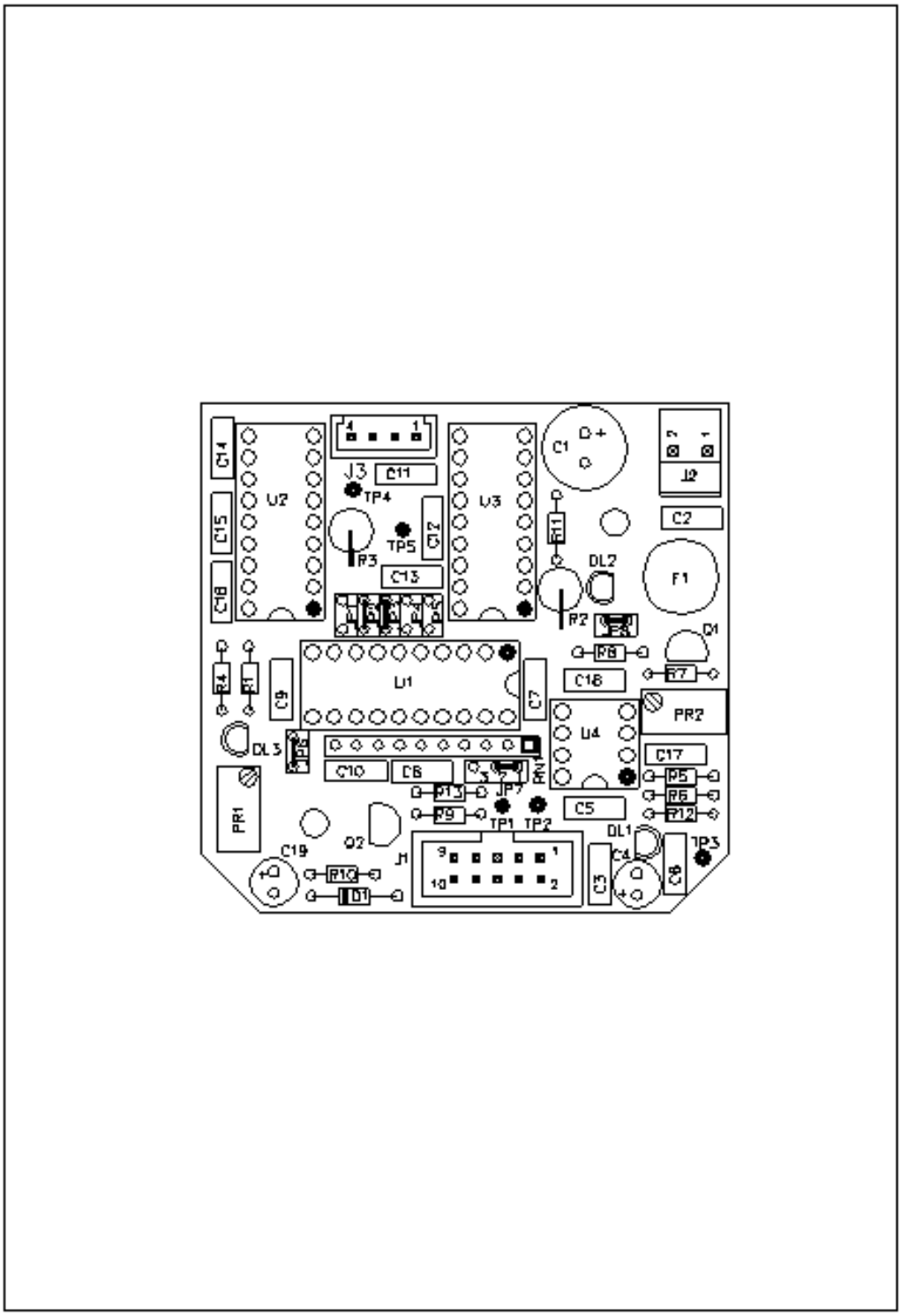
10.5.4 EB0033.03.A.SC (ELECTRICAL DIAGRAM)

10.5.5 EB0033.03.0.PM (ASSEMBLY DRAWING)

10.5.6 EB0122.01.0.SC (ELECTRICAL DIAGRAM)

10.5.7 8EB0122.01.0.PM (ELECTRICAL DRAWING)


C14
C15
C16
U2
J3
C11
TP4
TP5
P3
C12
C13
U3
C1
D+
J2
C2
R11
DL2
F1
P2
D1
P8
R7
C18
PR2
U4
C17
P5
P6
P12
C5
DL1
TP3
C4
C8
C3
R4
R1
C9
U1
C7
DL3
C10
C6
JP7
P13
P9
TP1
TP2
PR1
C19
Q2
J1
P10
D1


C14
C15
C16
U2
J3
C11
TP4
TP5
C12
P3
C13
U3
C1
J2
C2
R11
DL2
F1
P2
D1
R8
R7
C18
PR2
U4
C17
P5
P6
P12
R4
R1
C9
U1
C7
DL3
C10
C6
JP7
P13
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C19
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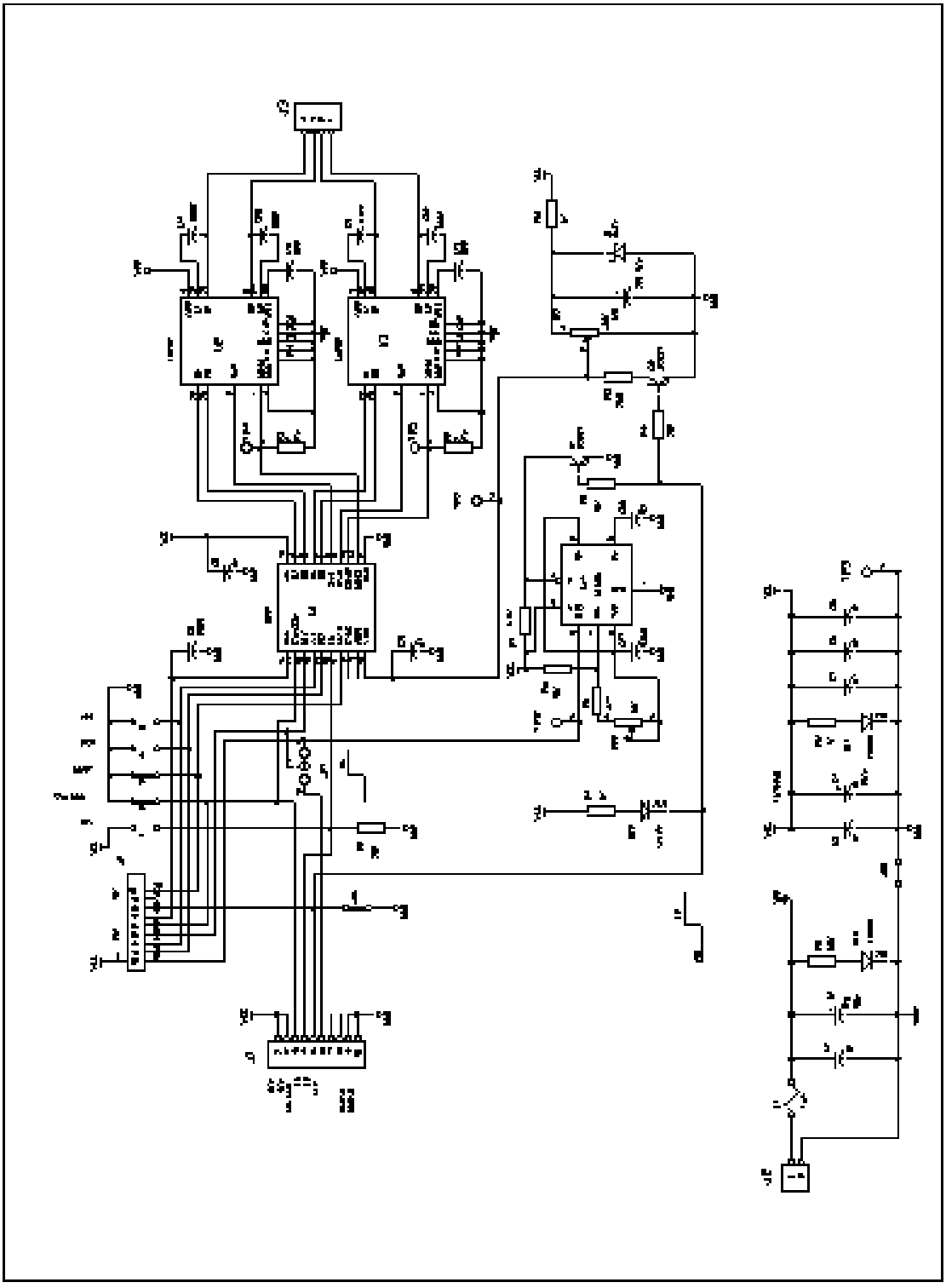
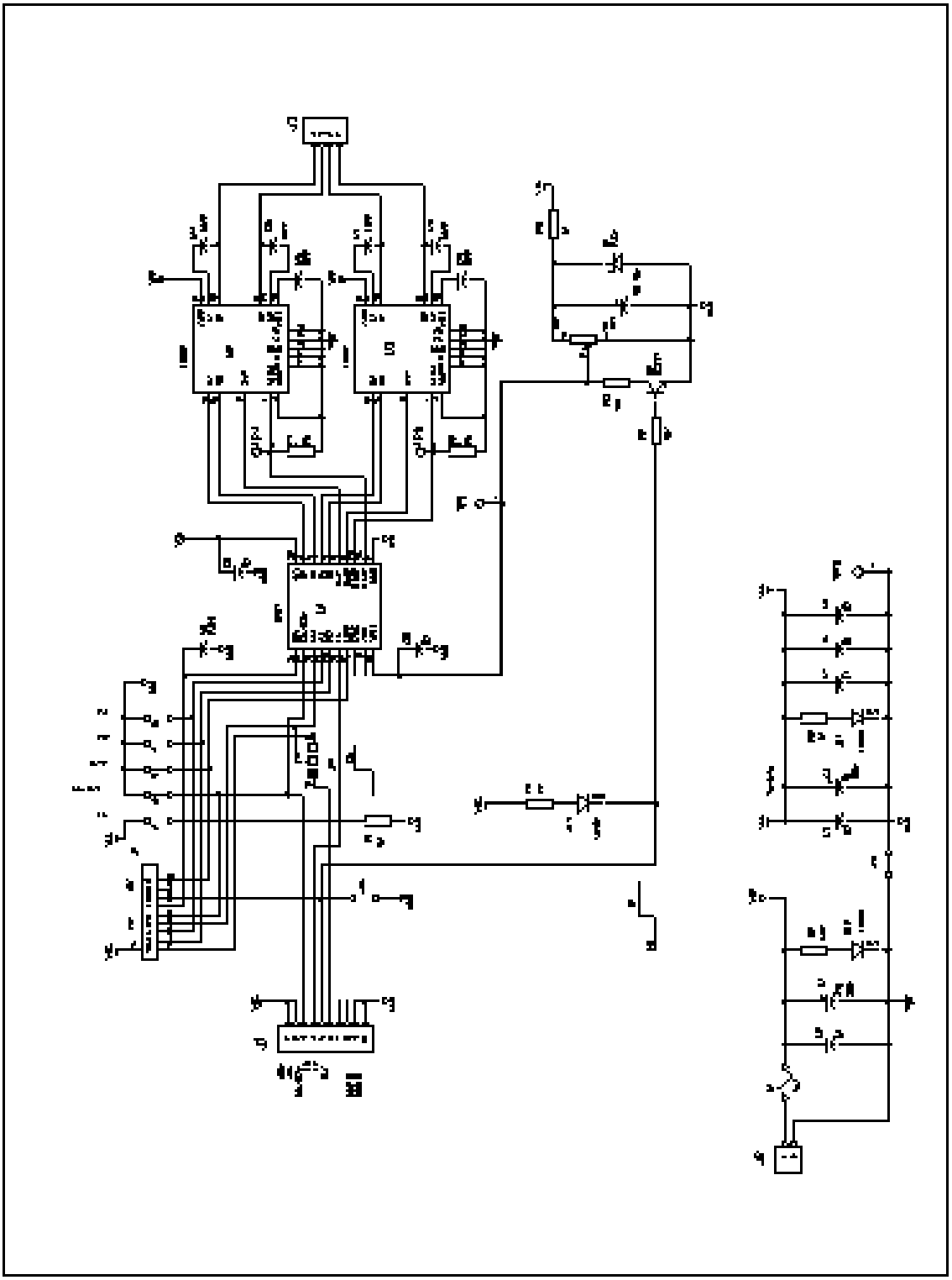
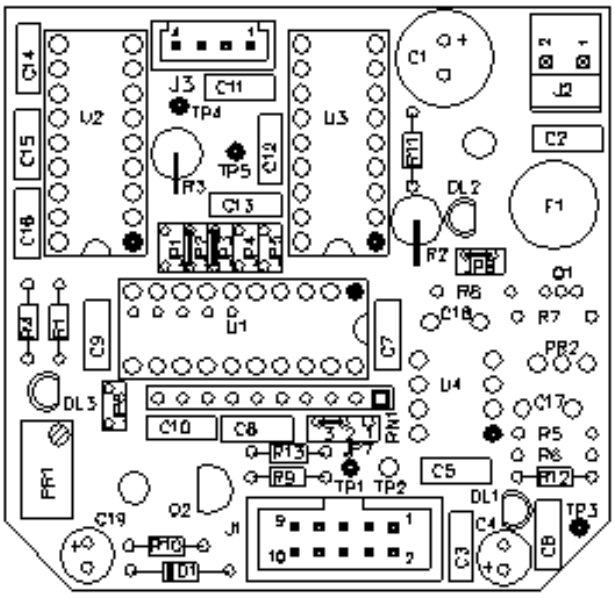
J1
P10
D1
C4
C3
C8






C14
C15
C16
U2
J4
J3
C11
TP4
TP5
C12
R3
C13
U3
C1
J2
C2
F1
R11
DL2
R2
Q1
R6
R7
C18
PR2
U4
C17
R5
R8
R12
C5
DL1
C4
C3
C6
TP3
R4
R1
C9
U1
C7
DL3
C10
C8
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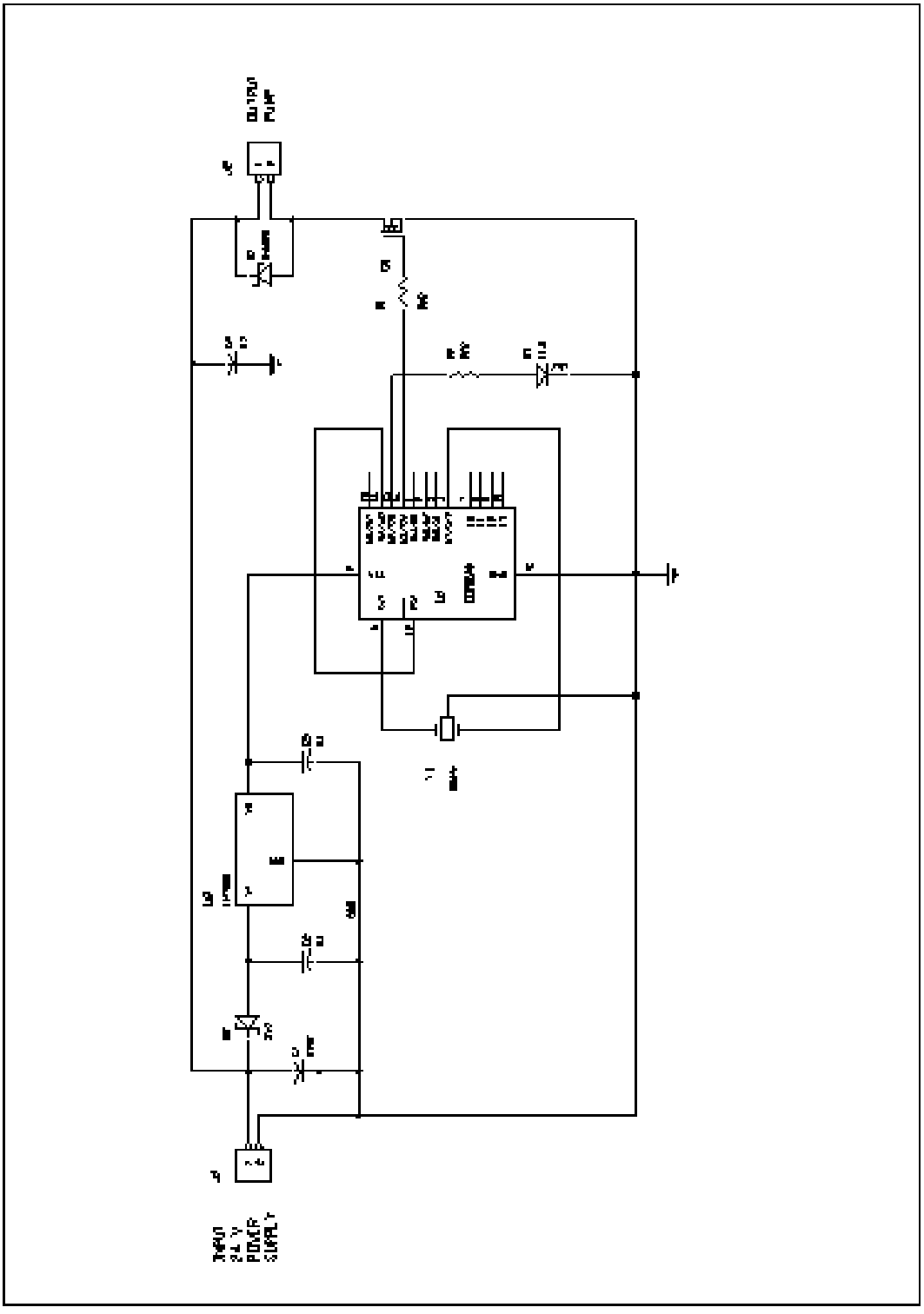
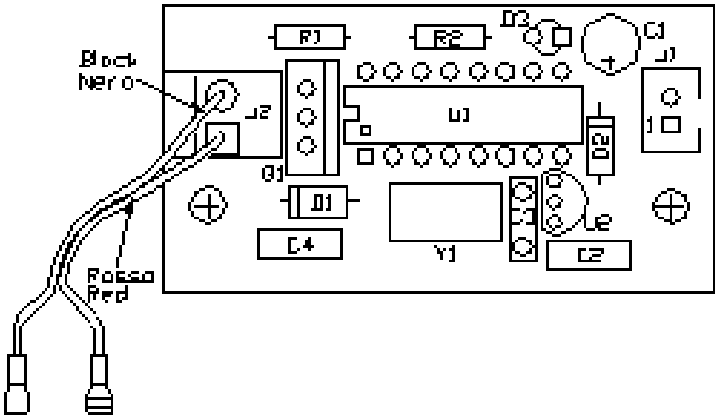
J1
C19
PR10
D1



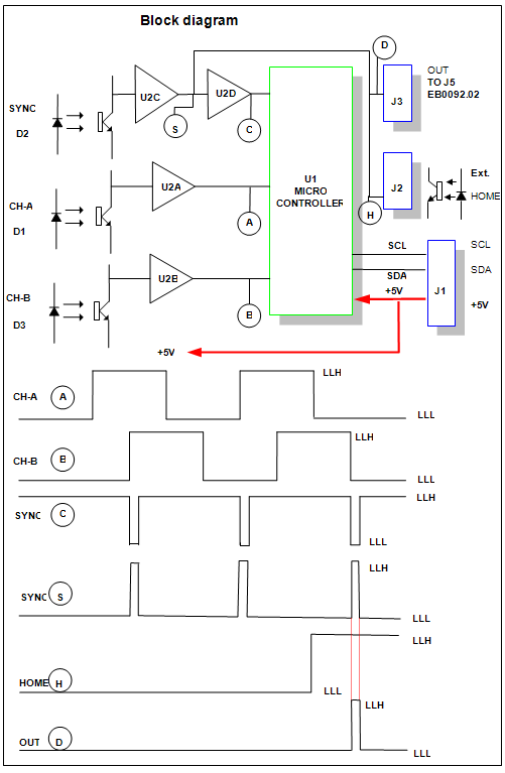

Black
Nero
Rosso
Red
R1
R2
D2
C1
J1
U1
C3
Q1
D1
C4
Y1
C2

11 ENCODER MOTORE

TECHNICAL DESCRIPTION

Function of this board is to verify the correct operation of the stepper motors.

- A disk mounted on the motor axis with a hole and two small concentric windows at 90° from each other, passes between two Opto switches D1 and D3, these generate two symmetric square waves (CH-A, CH-B). As the disk turns, a third optoswitch D2 generates a signal SYNC every 360° due to the hole in the disk.
- The signal SYNC together with the HOME signal determine the mechanical zero.
- The information is sent via a serial line SCL (serial clock) and SDA (serial data), from the µcontroller (U1) to the corresponding CPU slave board.
- The **Red LED** (DL6), indicates the presence of a signal from the serial clock (SCL), requested by the µcontroller (U1).
- The **Green LED** (DL5) indicates the presence of a serial signal (SDA) containing data and address of the peripheries requested by the µcontroller (U1).



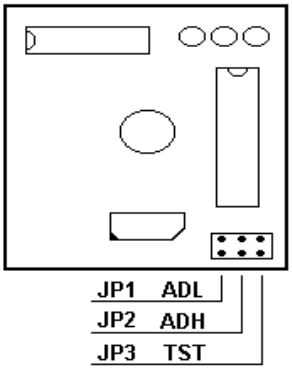
DO NOT change the positions of the jumpers.

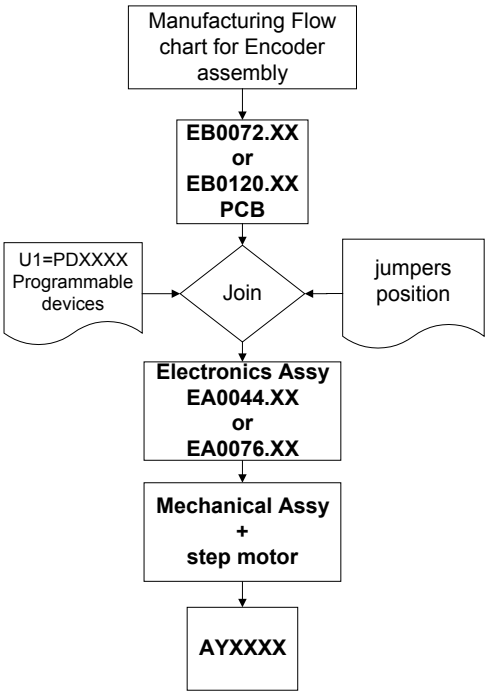
HARDWARE CONFIGURATION

Table 10 shows the position of the jumpers present on the board.

TABLE 12

Version Encoder	Assembly Mechanical	Position of jumpers JPX O=Open, C=Closed			Description
		JP1 (ADL)	JP2 (ADH)	JP3 (TST)	
EA0044.01	AY0105.01	O	O	O	Encoder vertical movement of Probe SAMPLE and REAGENT
EA0044.02	AY0168.01	C	C	O	Encoder rotational Arm movement REAGENTS
EA0044.02	AY0169.01	C	C	O	Encoder rotational Arm movement SAMPLE
LED	Color				
DL3	yellow	Synchronizing Signal			
DL5	Green	Signal transmission serial data			
DL6	Red	Serial clock signal			





The flow chart on the side, shows the sequence of the encoder assembly.

Scheda	Descrizione	Dispositivo	Layo. Ref.	Software P/N
EB0072.01	Encoder	PIC16F84A	U1	PD0053.01

TABLE 13
List of programmable Devices

DOCUMENTATION

EB0072.01.A.SC (electrical diagram)
EB0072.01.A.PM (assembly drawing)

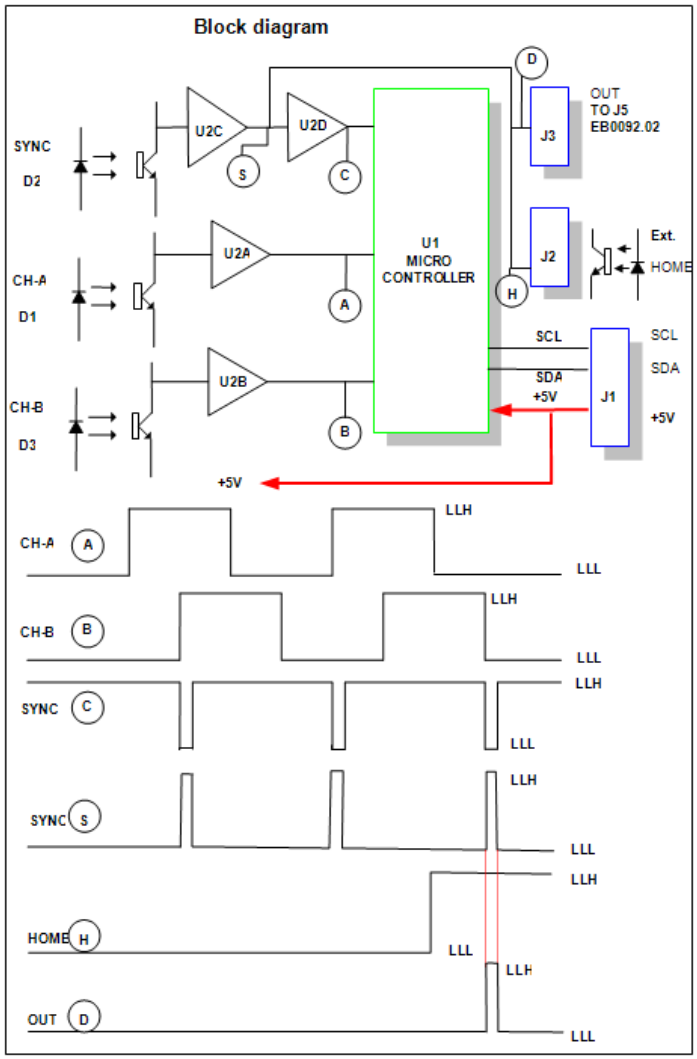
11.1 Encoder Motor + Home (P/N EB0120.01)

TECHNICAL DESCRIPTION

Its function is to verify the correct operation of the stepper motors.

- On the motor axis is mounted a disk with a small hole and two concentric windows at 90° between them. When passing through the two opto-switches D1 and D3, they generate two symmetric square waves (CH-A, CH-B). By turning the disk with the small hole passes a third opto-switch D2 that generates a SYNC signal every 360°.

- When the signal SYNC (D) coincides with the external signal HOME (H), this becomes the correct mechanical ZERO.
- Data is sent via a serial line SCL (serial clock) and SDA (serial data), from the µcontroller (U1) to the corresponding CPU slave board.
- The red LED (DL6), indicates the presence of a signal from a serial clock (SCL), requested by the µcontroller (U1).
- The green LED (DL5), indicates the presence of a serial signal (SDA) which contains data and the peripheral address, requested by the µcontroller (U1).
- The timing graph as indicated in the block diagram and in the Table the two signals SYNC (S) and external HOME (H) are shaped between them in logic AND (D). Both LED, DL3 and DL7 will be continuously ON only when the two signals are LLH which corresponds to the mechanical ZERO position.



Signal Table

In		Out
HOME (H)	**SYNC (S)**	**OUT (D)**
LLL	LLL	LLL
LLL	LLH	LLL
LLH	LLL	LLL
LLH	LLH	LLH

! DO NOT change the position of the jumpers.

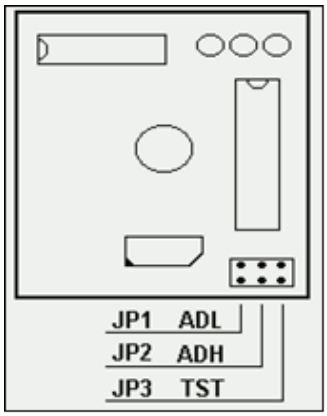
! To see assembly sequence, go to the previous paragraph.

HARDWARE CONFIGURATION

„Table 12“ indicates the position of the jumpers present on the board

TABLE 14

Version Encoder	Mechanical Assembly	Position of jumpers JPX O=Open, C=Closed			Description
		JP1 (ADL)	JP2 (ADH)	JP3 (TST)	
EA0076.02	AY0163.01	C	O	O	Encoder rotation SAMLE plate
EA0076.02	AY0164.01	C	O	O	Encoder rotation REAGENT plate
EA0076.01	AY0104.04	O	O	O	Encoder rotation Cuvette analitycal plate
LED	Colore				
DL3	Giallo				Segnal SYNC
DL5	Verde				Segnal serial data transfer
DL6	Rosso				Serial clock signal
DL7	Giallo				Segnal HOME – SYNC in AND



Board	Description	Device	Layo.Ref	Software P/N
EB0120.01	Encoder	PIC16F84A	U1	PD0053.01

DOCUMENTATION

EB0120.00.0.SC (electrical diagram)
EB0120.01.0.PM (assembly drawing)

11.2 Maintenance

Remove the outside covers. (See „18 Maintenance“)

Operation to be done with analyzer turned OFF.

11.2.1 REPLACEMENT OF THE ENCODER BOARD

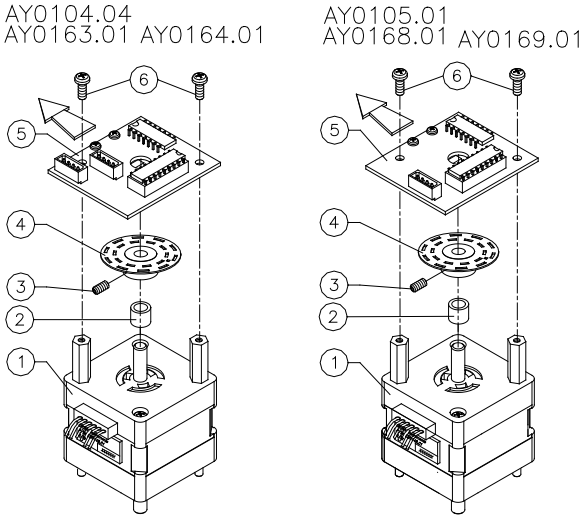
1. Remove the two connectors J1 and J3 (if mounted) from the encoder assembly (5) P/N: EA0076.xx o EA0044.xx.
2. Remove the loose connector (P1) from the driver module P/N: 17970/20 - 23 (only EA0076.xx).
3. Remove screws (6). Take out the encoder board. In order not to damage the disk follow the indication of the arrow as shown in the figure below.
4. Replace the board, and reassemble following the procedure in reverse. (Insert the
5. Connectors into their correct positions)

The replacement procedure of the board is the same for all the models. The mechanical replacement of the complete assembly or the encoder disk (4) see the “General Maintenance”.

Legend:

Ref.	Description
1	Motor Assembly
2	Spacer
3	Fixing nut
4	Encoder disk
5	Encoder board
6	Screws

Make sure to replace the board always with exactly the same model and Code as indicated on its identification label. The board replacement does not require any adjustments. If replacing the encoder disk (4) see the adjustments necessary as described in „18 Maintenance“.



11.3 Trouble Shooting Guide

This section lists a series of symptoms and problems and how to solve them. To solve some of the problems use the Diagnostic Program - **"HUMASTAR 300 TOOLS"**.

Defect	Causes and Remedies
	This procedure is valid for all encoders.
Operating program signals "FATAL ERROR ..." indicating which movement generated the error. **Possible cause:** **missing signal SYNC**	- Check the start up PWR ON voltage of both the Reagent and Sampling Systems. (see also „3.5 Trouble Shooting Guide".) - Check voltage +5V on J1 - Move it manually to check if the diodo yellow led DL3 is ON. - If necessary adjust the alignement of the signals HOME and SYNC - Remove the the encoder board. - Clean delicately (dust accumulation) the encoder disk using a soft brush. - Replace the programmable device. PD0053. xx - Replace the encoder board.
Difficult to read the number of steps of the encoder.	- Check the same operations described above.

	This procedure is valid for all encoders.
Operating program signals "FATAL ERROR ..." indicating which movement generated the error. **Possible cause:** **Communication problems** **Friction in the moving parts.**	- Check, perform a manual Reset of the CPU slabe board and make sure that the DL5 and DL6 are flashing intermittently. - Check the start up PWR ON voltage of both the Reagent and Sampling Systems. (see also „3.5 Trouble Shooting Guide".) - Check voltage +5V on J1 - Replace the programmable device PD0053.xx - Replace the encoder board - Replace the CPU slave board of the Reagent, Cuvette or the Sample System. - In absance of power supply of +24V, PWR OFF, check manually and make sure there is no friction or impediments in the moving parts. - If the cause is due to friction, lubricate the mechanism with a few drops of very light oil. - Make sure that the encoder disk is centered inside the opto detector on the encoder board. - If the cause id due to a mechanical blockage, it is suggested to see the the section in „18 Maintenance". - Replace the motor driver module EB0092.xx.

11.4 Spare Part List

Code	Description	QTY
EA0044.01	Encoder vertical movement of Probes both Sampling and Reagents.	2
EA0044.02	Encoder Arm movement of both the Sample and Reagent.	2
EA0076.01	Encoder rotation of the Cuvette Reaction plate	1
EA0076.02	Encoder rotation of the Sample and Reagent plates	2
PD0053.01	● Programmable device for EA0076.XX and EA0044.XX	1

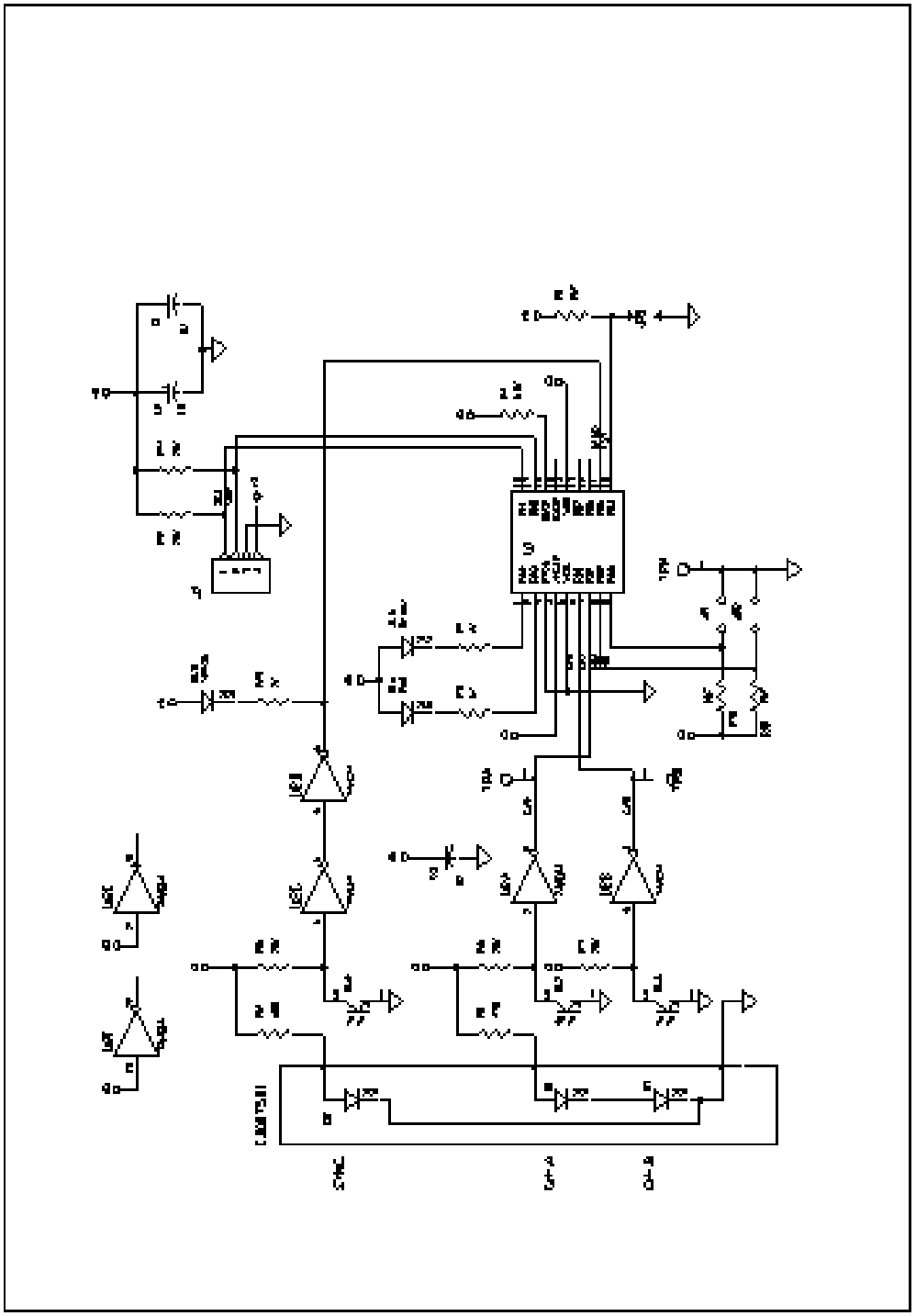
11.5 Enclosed Documentation

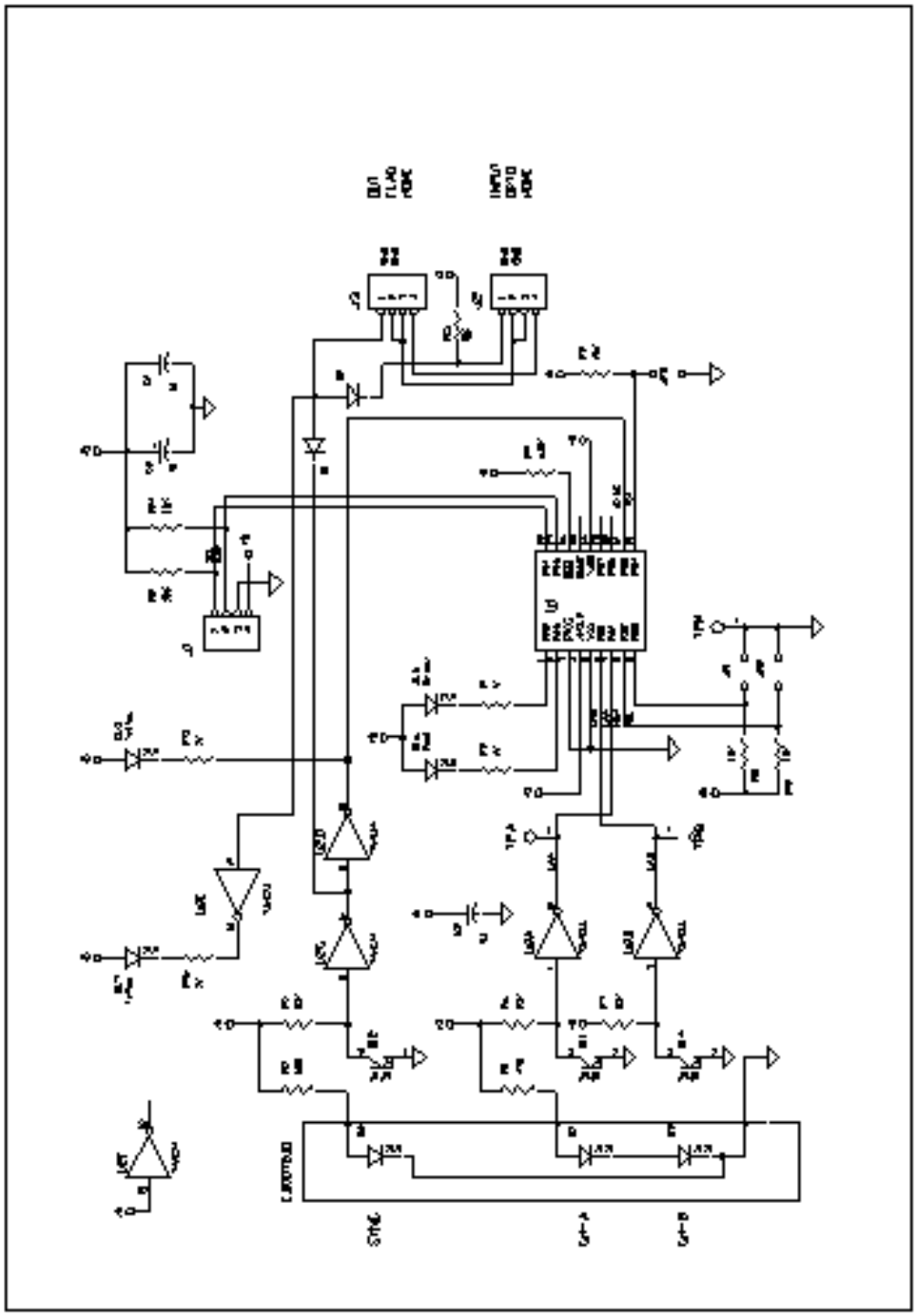
11.5.1 EB0072.01.A.SC (ELECTRICAL DIAGRAM)

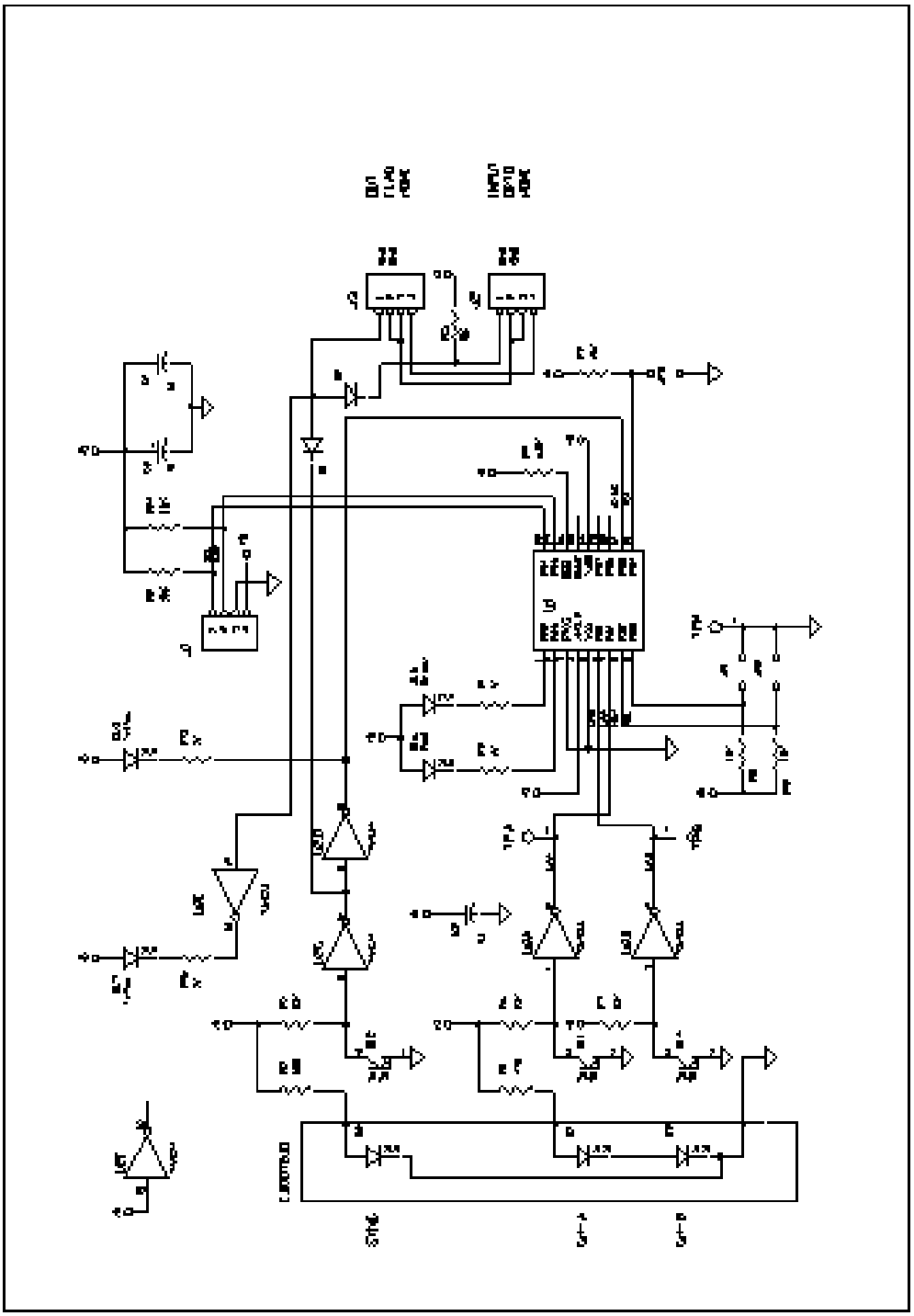
11.5.2 EB0072.01.A.PM (ASSEMBLY DRAWING)

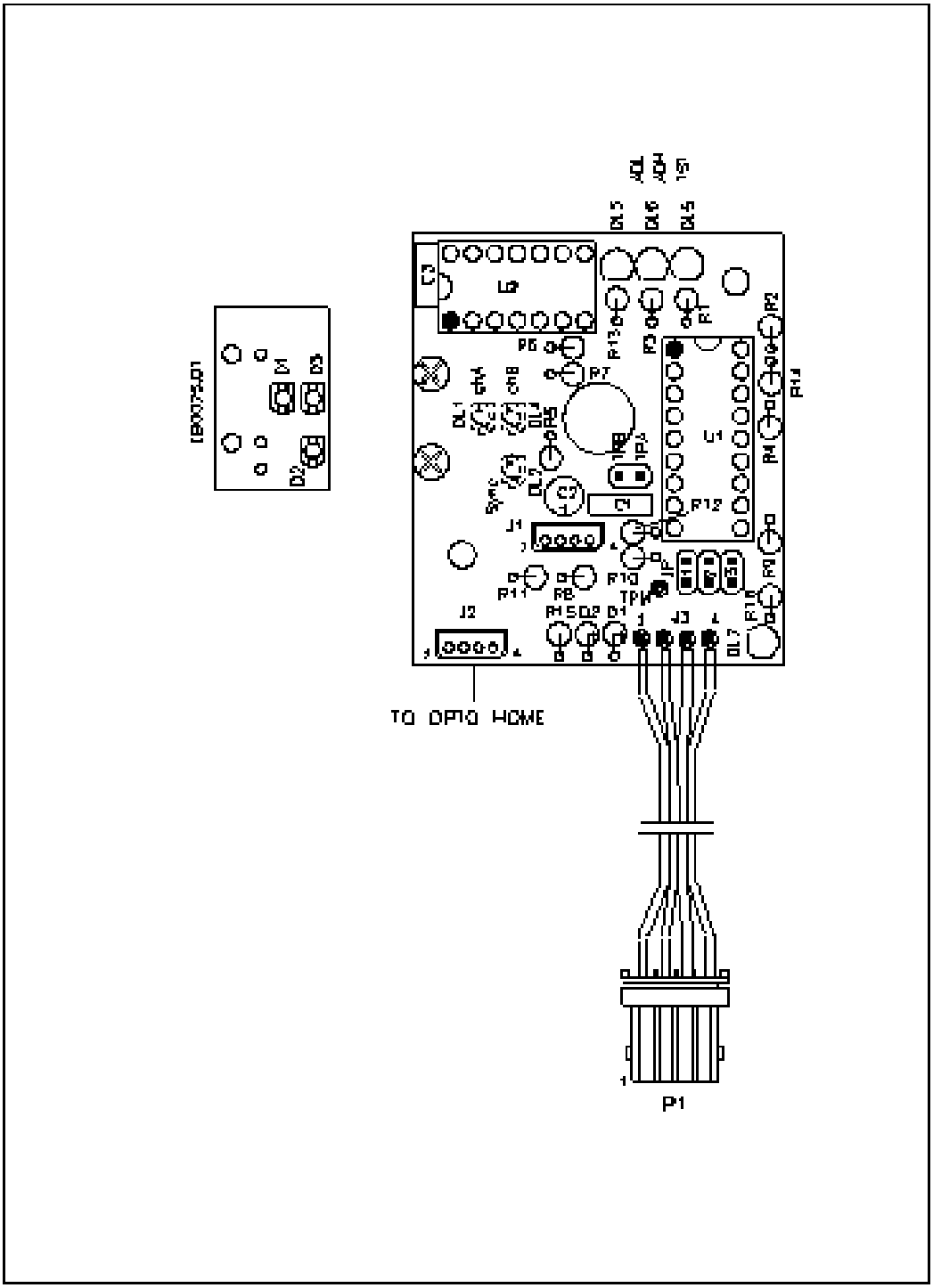
11.5.3 EB0120.00.0.SC (ELECTRICAL DIAGRAM)

11.5.4 EB0120.01.0.PM (ASSEMBLY DRAWING)





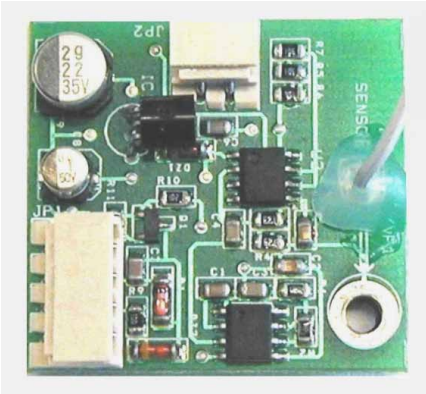



TO OPTO HOME
P1

12 LIQUID LEVEL SENSOR (P/N:17970/31)

TECHNICAL DESCRIPTION

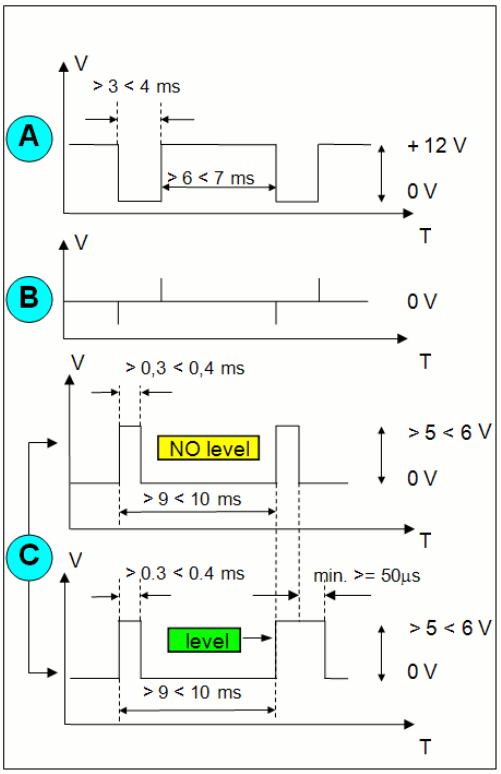
FIGURE 39



Function: A circuit inside the Probe that enables to detect the presence and the level of a reagent and/or sample. It's a capacitive type of operation based on the measurement of a variation in signal coming from a square wave due to an additional capacity of the liquid in contact with the probe.

- The oscillator U1, generates a frequency (**A**), „Figure 36“
- The oscillator U2 ordered by ‚impulse (**B**), generates a frequency (**C**), „Figure 36“. In standby, the output signal **C**) (**NO LEVEL**) has a duration of 0,3-0,4 ms, when the probe comes in contact with a liquid (**LEVEL**), the duration of the signal increases in function of the capacity of that liquid. (minimum 50µs).

The measured volume of reagent inside the container is expressed into the number of tests that can be performed, based on the volume necessary per test programmed in the method.



Bottle Type : **type 1= 50ml**
type 2= 6ml

Documentation
17970/31.0.SC (electricaldiagram)
17970/31.0.PM (assembly drawing)

! All the following operations are to be made with analyzer turned OFF.

12.1 Maintenance

12.1.1 REPLACEMENT OF LEVEL SENSOR AND ITS FLAT CABLE

- Level Sensor Board

1. Remove the teflon tubing connected to the probe.
2. Remove the screws and the Arm cover.
3. Remove connectors JP1 (flat cable) and JP2 (mixing motor).
4. Loosen the screw holding the flat cable to the probe holder and replace the board.

- Flat Cable

5. Remove connector JP1.
6. Cut the ribbon holding the cable (or remove the screw), loosen the GND terminal, disconnect connector P2 and replace the flat cable.

12.2 Trouble Shooting Guide

This section lists a series of problems and how to solve them. To solve some of the problems use the Diagnostic Program "**HUMASTAR 300 TOOLS**".

Defect	Causes and Remedies
The probe descends all the way to the bottom, but does NOT reveal the level of the liquid, or sometimes does not reveal the Reagent level.	- Make sure that the connection between the board EB0124.xx and the Probe support is not broken. - Make sure that the Probe is correctly fixed. - Check the GND connection of flat cable WC0101.02 - Clean the Probe both inside and outside with alcohol and inside with a stainless steel wire. - Make sure that the syringe ppiston does NOT leak and is isolated from the diluter support. - Make sure there is no foam inside the reagent bottle or sample cup. - Make sure that the reagent bottle or the sample cup is TOO full. - Wash solution has too much foam and becomes conductive. - Replace flat cable WC 0101.02 - Replace board **17970/31**
Probe enters jerkily into the liquid.	- Prepare fresh Wash solution using fresh dist. Water. - Check the GND connection of the cable WC0101.02 - Replace flat cable WC 0101.02 - Replace board **17970/31**
Level Sensor stops above the liquid – reagent or sample and does NOT go down.	- Make sure there is a plastic isolator that separates the Probe from the mixer motor cam - Replace the cable WC 0101.02 - Clean the decoder disk, use a soft brush. - Replace board **17970/31** - Replace the CPU slave board 17970/8 Reagents or Sample System

The mixer does NOT work	- Check the start ip PWR ON of the Reagent and Sampling Systems. (see also „3.5 Trouble Shooting Guide“) - Check voltage + 24V on JP1 - Remove the connector from the motor JP2 and check its resistance (about 10 Ohm), if necessary replace the mixer motor EM0038.01 - In the Diagnodtic program activate the test MIXER. Check on pin 2 of JP1 a signal variation from 0 to +5V. If absent, replace the CPU slave board 17970/8 Reagents or Sampling System. - From the Diagnostic Program activate the test MIXER. Check between pin 1 e 2 of JP2 about +24V, if absent, replace the board **17970/31**

12.3 Spare Part List

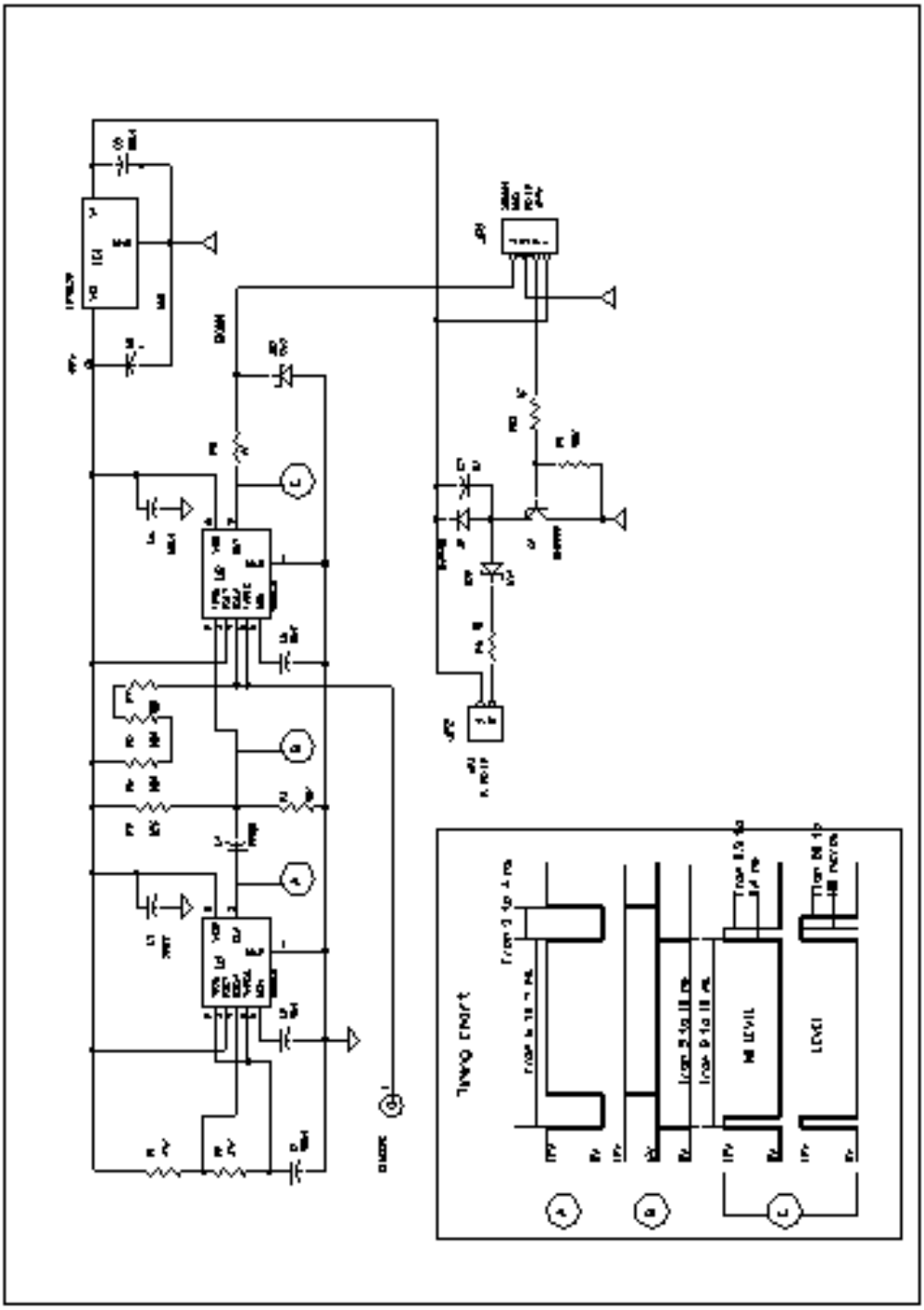
! To assure a rapid and efficient technical service to the clients, HUMAN suggests to keep in stock all the parts marked with (•). When ordering parts make sure to include: Code Number, Description and Quantity.

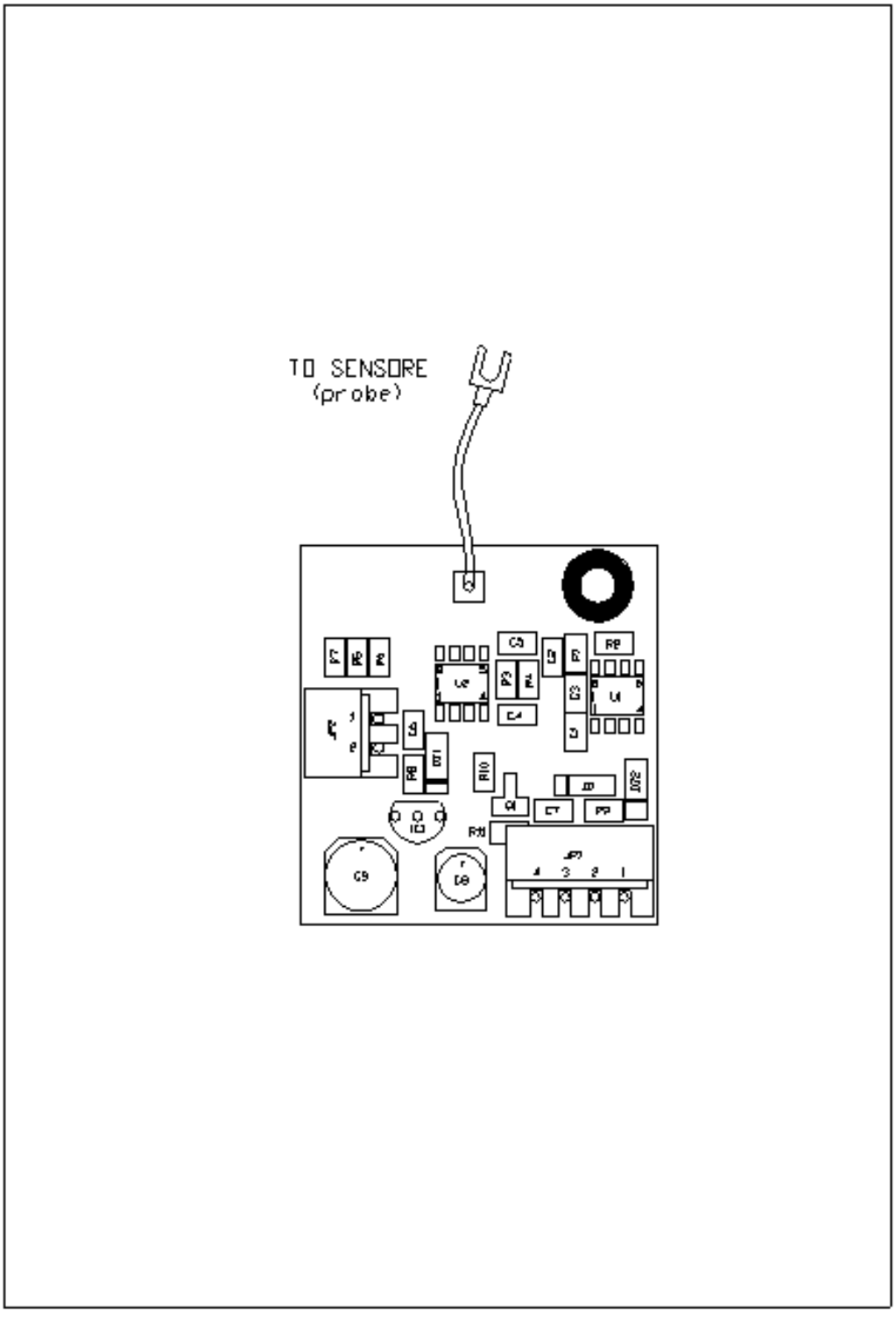
Code	Sub_Code		Description	QTY
17970/31			Level sensor board	1
	WC0101.02	●	Flexible flat cable	1

12.4 Enclosed Documentation

12.4.1 17970/31.0.SC (ELECTICAL DIAGRAM)

12.4.2 17970/31.0.PM (ASSEMBLY DRAWINGS)




TO SENSORE
(probe)

13 OPTICAL SENSOR (P/N: EB0086.XX, PN: EA0071.01, P/N: EA0075.01)

TECHNICAL DESCRIPTION

- This device an (**Optical switch**) is used in several modules to detect the correct mechanical position of HOME or SYNC. These have two levels LOW or HIGH (LLL o LLH) namely (0 / +5 V).

The boards are as follows:

- EB0086.06 signal HOME – Sample Plate
- EB0086.07 signal SYNC – filter wheel
- EB0086.08 signal HOME – filter wheel
- EB0086.09 signal HOME – Sampling Arm
- EB0086.10 signal HOME – Reagent Arm
- EB0086.11 signal HOME – Cuvette Washing Arm
- EB0086.12 signal HOME – Reaction Cuvette Plate
- EA0075.01 signal HOME – Reagent Plate
- EA0071.01 signal HOME – Reagent and Sampling Probes

DOCUMENTATION

EB0086.00.0.SC	(electrical diagram)
EA0071-75.00.0.SC	(electrical diagram)

13.1 Maintenance

To replace these parts see “General Maintenance”.

13.2 Trouble Shooting Guide

This section lists a series of Symptoms and Problems and how to solve them. To solve some of the problems use the Diagnostic Program "**HUMASTAR 300 TOOLS**".

Defect	Causes and Remedies
Operating Program signals "**FATAL ERROR .....**" when performing mechanical Zero setting: **Possible cause:** Error in HOME position	**This procedure is valid for all the Optical Sensors.** - Clean the sensor - Check that the yellow LED (DL5) is ON on the driver modules 17970/20 - 23 - Check that the yellow LED (DL7) is ON on the encoder boards EA0076.xx of the three plates - With the sensor cable connected, check the signal variation from LLL to LLH on pin1 on connector P1 - With the sensor cable connected, check the power supply voltage of sensor, 1,2 V on pin 4 of connector P1 - Replace the sensor

13.3 Spare Part List

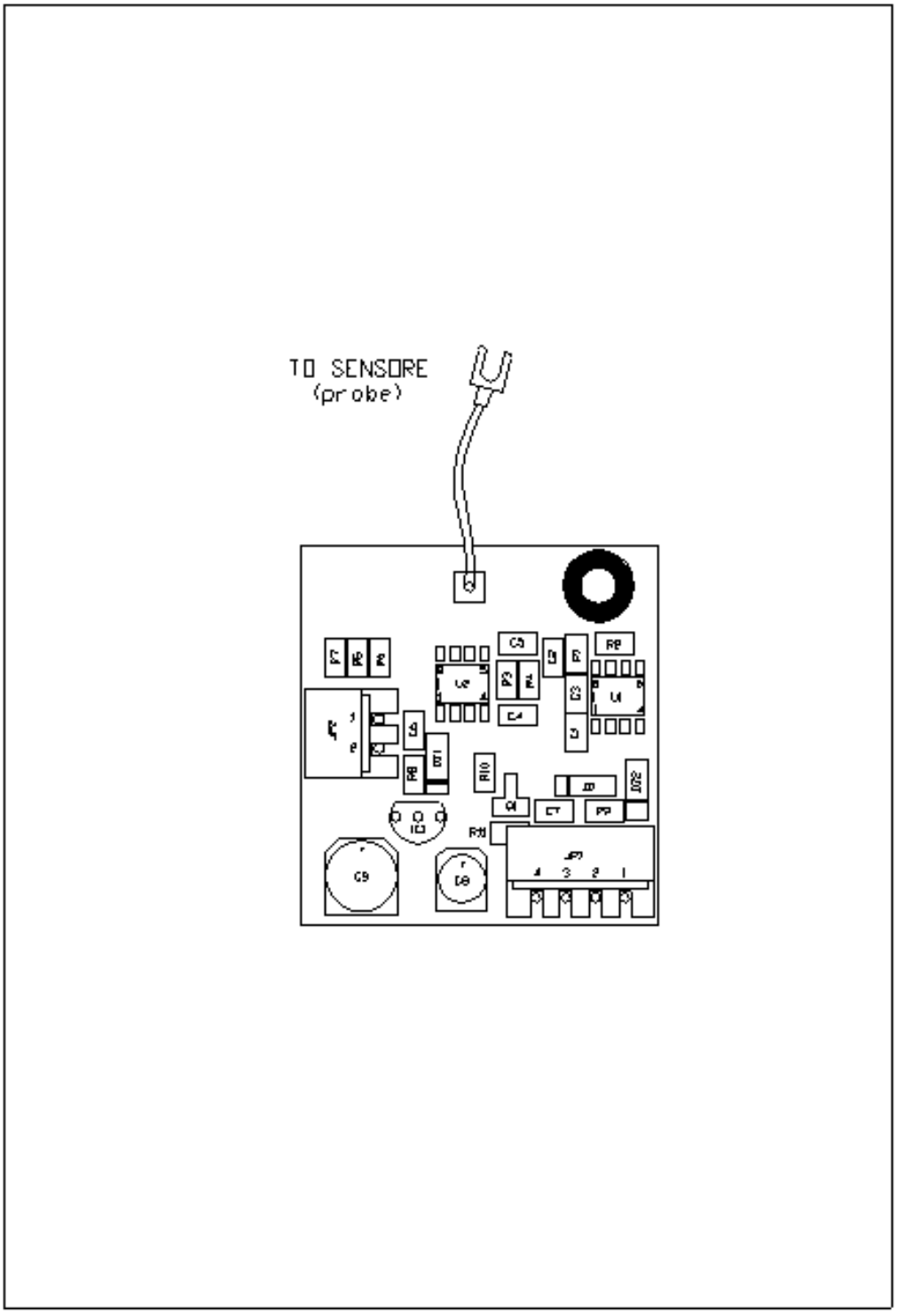
! To assure a rapid and efficient technical service to its clients, HUMAN suggests to keep in stock the parts marked with (•). When ordering parts include the following information: Code Number, Description of part and Quantity.

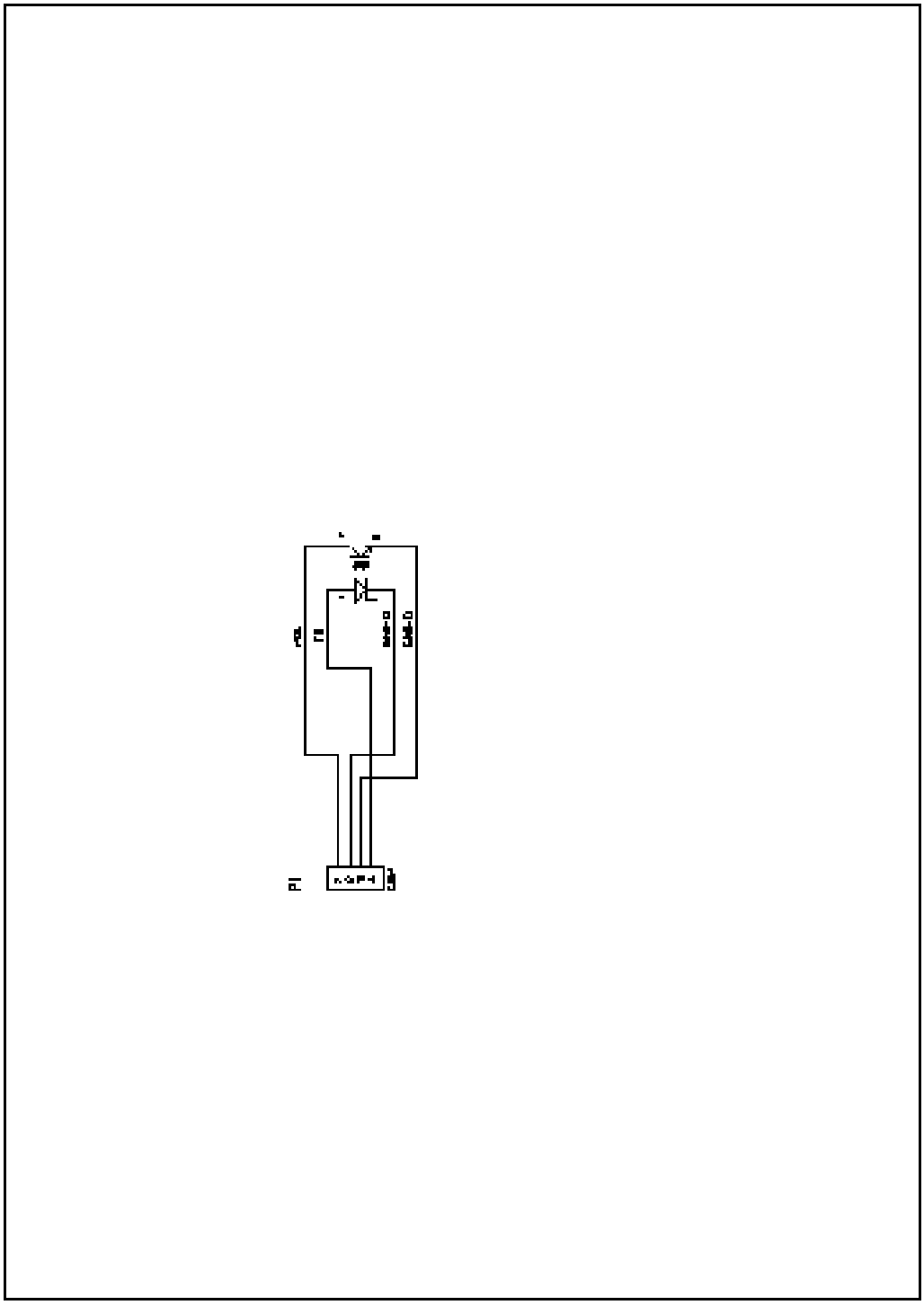
Code	Sub_Code	Description	QTY
EB0086.06		HOME – Sample Plate	1
EB0086.07		SYNC – filter wheel	1
EB0086.08		HOME – filter wheel	1
EB0086.09		HOME – Sampling Arm	1
EB0086.10		HOME – Reagent Arm	1
EB0086.11		HOME – Cuvette Washing Arm	1
EB0086.12		HOME – Cuvette Plate	1
EA0075.01		HOME – Reagent Plate	1
EA0071.01		HOME – Reagent and Sampling Probes	2

13.4 Enclosed Documentation

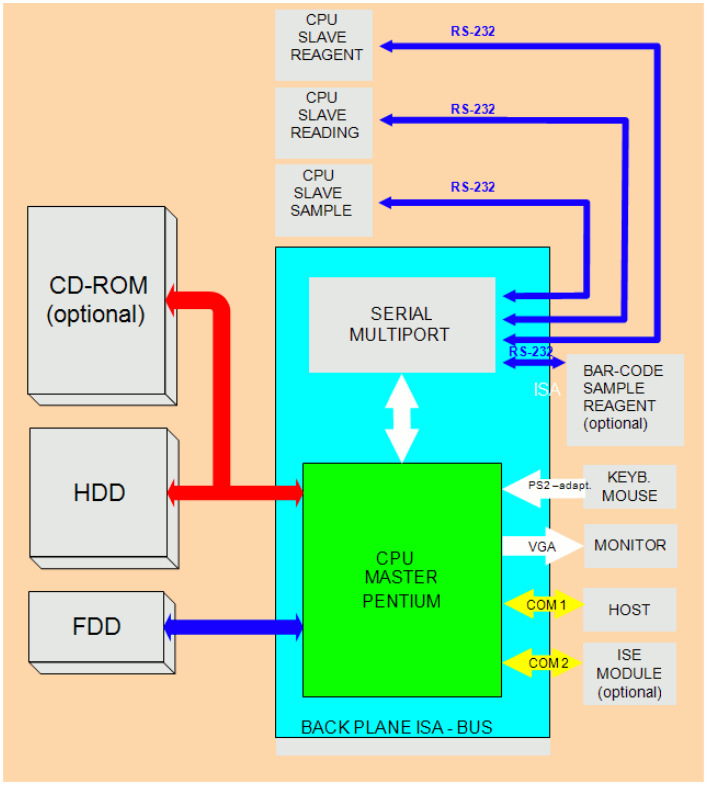
13.4.1 EB0086.00.0.SC (ELECTRICAL DIAGRAM)

13.4.2 EA0071-75.00.0.SC (ELECTRICAL DIAGRAM)


TO SENSORE
(probe)



14 COMPUTER MODULE (P/N: AY0096.01, P/N: AY0199.01)



DESCRIPTION

The computer module (see the block diagram) consists of a passive back-plane board (**17810/7**), a CPU Master board (**17889**) and a multi-serial board (910.002.031).

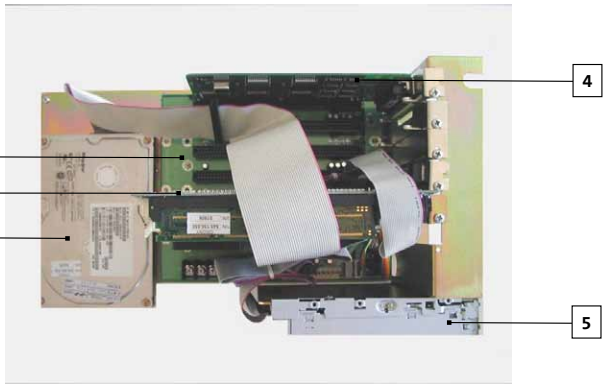
The CPU master board has the following functions:

- To control the three SLAVE boards and the Bar Code reader via the multi-serial board.
- Controls the H.D.D. and the F.D.D.
- Sends images to the monitor
- Controls the printer.
- Receives input data from the keyboard and mouse through an adaptor PS2
- Sends and receives data from outside through the serial port (COM1)
- Sends and receives data from the ISE module (optional) through the serial port (COM2)

! In assembly AY0199.01 the H.D.D. is positioned vertically between the computer board and the multi-serial board.

To identify correctly the various parts – see the figures below.

1 VGA Motor
2 COM1 Host
3 Mouse Keyboard
4 COM2 - ISE
5 Printer
6 Serial Multiport



1 6 Slot ISA BUS
2 Computer
3 H.D.D.
4 Serial Multiport
5 F.D.D.

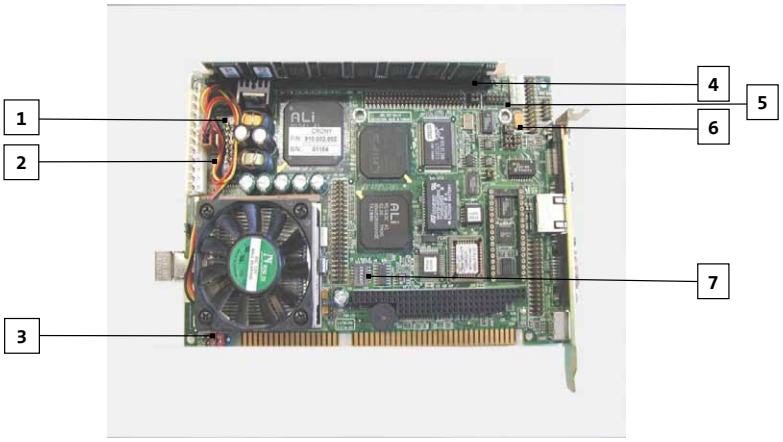
14.1 Computer PC Master (P/N: 17889)

DESCRIPTION OF THE HARDWARE

- CPU : PENTIUM - INTEL 233MHz MMX
- RAM : DIMM 64MB

Internal Peripherics

- OUTPUT VIDEO
- CONTROLLER for H.D.D.and F.D.D.
- SERIAL PORTS COM1 – COM2
- PARALLEL PORT LPT1



1 CN1
2 S1
3 J1
4 J3
5 J5
6 J6
7 S2

Settino jumpers
ATTENTION ! a WRONG configuration could DAMAGE the CPU.

S1-1	OFF	S2-1	OFF	J1	3,3V-3,3V
S1-2	OFF	S2-2	ON	J3	5-3 6-4
S1-3	ON	S2-3	ON	J4	1-2
S1-4	OFF	S2-4	OFF	J5	1-2
S1-5	OFF	S2-5	OFF	J6	1-2,4-5,7-8,10-11
S1-6	OFF	S2-6	OFF	CN1	8-10

14.2 Passive Board 6 Slot ISA BUS (P/N: 17810/7)

DESCRIPTION

- Expands the connections ISA BUS for 6 slots
- Indicates, via four LED, the presence of the power supply voltages
- All power supply voltages are available on a connecting terminal.
- Additional input for an auxiliary keyboard.

14.3 Multi - Serial Port (P/N: 910.002.031)

DESCRIPTION

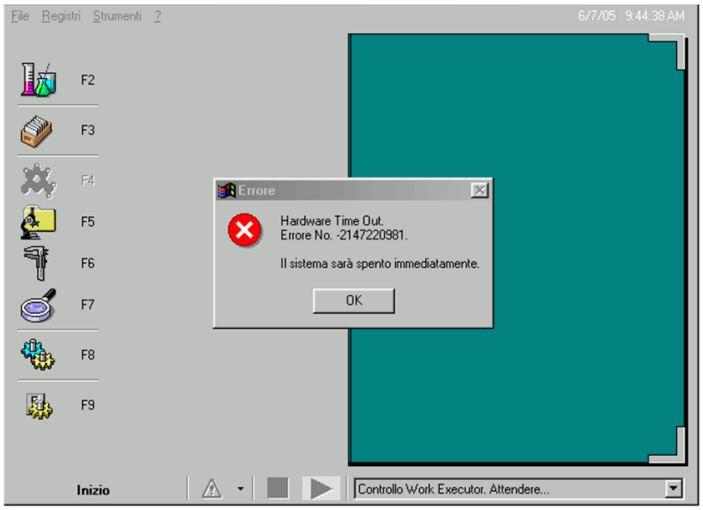
Supplies to the CPU Master board four serial ports, furthermore communication with the three CPU SLAVE boards and the Bar Code reader.

Position of jumper

JP1	Open

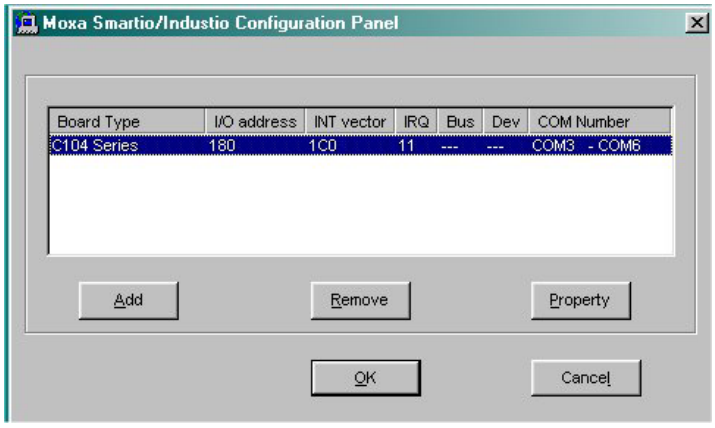
14.3.1 CHECK AND THE CONFIGURATION MULTI-SERIAL BOARD PARAMETERS

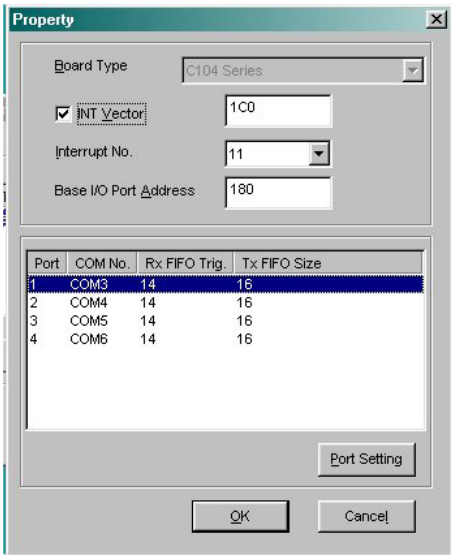
The image on the side indicates the error signal, when the serial communication between the CPU master and the three CPU slaves is absent or the configuration of the ports is wrong.



For a correct configuration of the multi-serial board proceed as below:

- Turn ON the analyzer and wait for booting. When the first **green** image appears on the monitor, press the key "**CTRL**" until all the desktop Windows is loaded.
- From desktop Windows click on key **[START]** and select in succession **[MOXA Utilities] [Moxa C102-C104-C108 Configuration Panel]**, the figure on the right will be displayed.
- Click on key **[Property]**, - display on the right.
- Check that all the parameters coincide with those displayed on the right. If necessary modify them.
- If the port parameters are different, click on **[Port Setting]**. Select the ports with erroneous parameters and introduce the new correct parameters as shown in figure on the right.

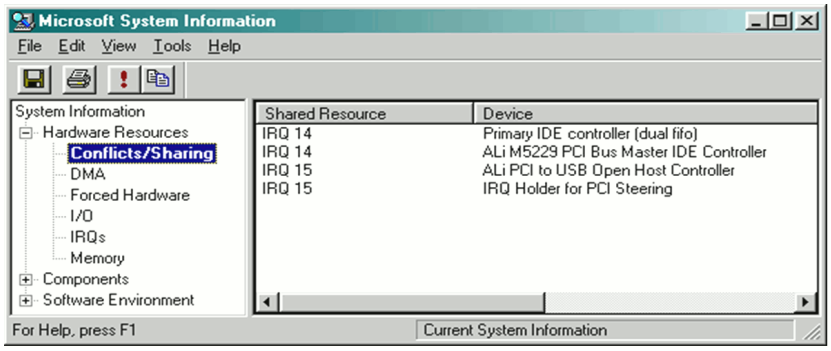




To check if there is a hardware difference between the peripheries. Proceed as follows:

From desktop Windows click on **[START]** and select in succession **[Programs] [Accessories] [System Tools] [System Information]**, the below figure will be displayed.

! Should the Time-Out problem persist see the "Trouble Shooting Guide" below.



- Select **[Hardware Resources]** and then **[Conflict/Sharing]**, if on the right hand side on the display appears "Moxa Smartio/Industio multiport board" it is suggested to re-install the operative software from the CD-Rom.

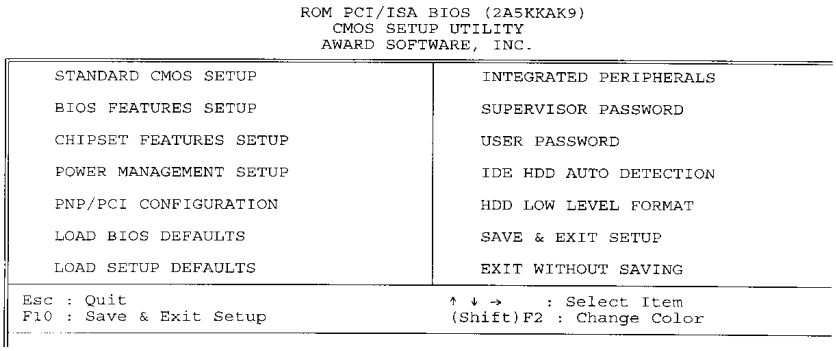
14.4 Configuration of BIOS

Configuration of BIOS board CPU PENTIUM tipo SBC-557 con LCD TFT Nec (BIOS Rev. 1.4 12/07/2001 – Rev. 1.5 07/25/2002)

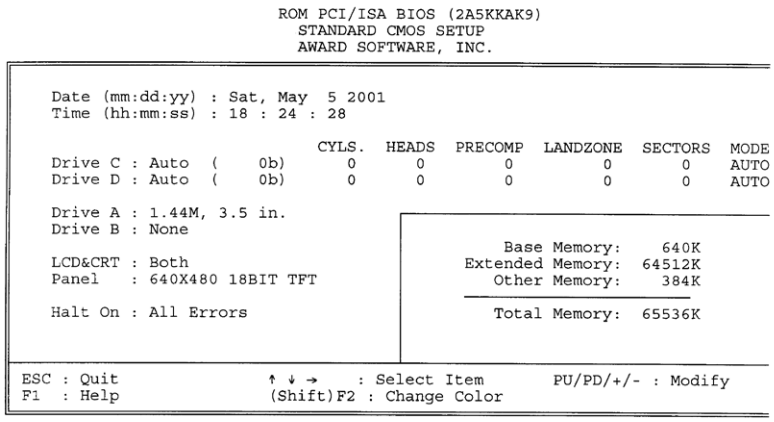
Use the following procedure when:
- Problems when installing Windows98SE.
- Replacement of the battery memory buffer CMOS.
- There are problems with the peripheries

1. Turn ON the analyzer and wait for the boot procedure. The display will show the memory control and some information about the BIOS. Press "DEL" or "CANC" on the keyboard to enter the Main Menu of SETUP, the following image will be displayed:

- To move inside the Menu use the arrows "↑ ↓"
- To enter the sub-menu use keys "Invio" or "Enter"
- To modify parameters use "Pag ↑" and "Pag ↓"

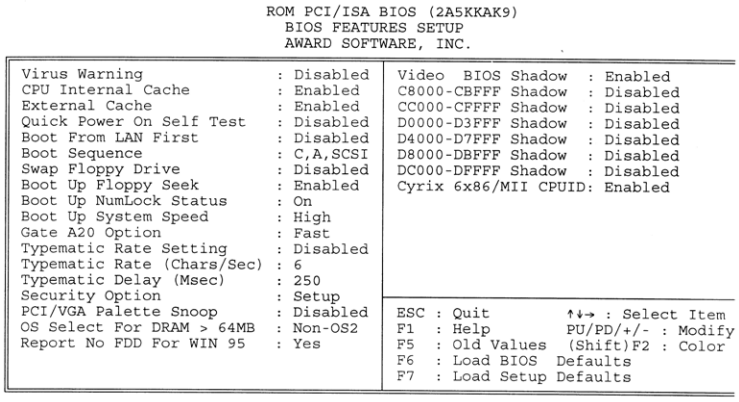


2. Select 'STANDARD CMOS SETUP ' and enter the parameters as shown below:


ROM PCI/ISA BIOS (2A5KKAK9)
STANDARD CMOS SETUP
AWARD SOFTWARE, INC.
Date (mm:dd:yy) : Sat, May 5 2001
Time (hh:mm:ss) : 18 : 24 : 28
CYLS. HEADS PRECOMP LANDZONE SECTORS MODE
Drive C : Auto (0b) 0 0 0 0 0 AUTO
Drive D : Auto (0b) 0 0 0 0 0 AUTO
Drive A : 1.44M, 3.5 in.
Drive B : None
LCD&CRT : Both
Panel : 640X480 18BIT TFT
Halt On : All Errors
Base Memory: 640K
Extended Memory: 64512K
Other Memory: 384K
Total Memory: 65536K
ESC : Quit
F1 : Help
↑ ↓ → : Select Item
(Shift)F2 : Change Color
PU/PD/+/- : Modify

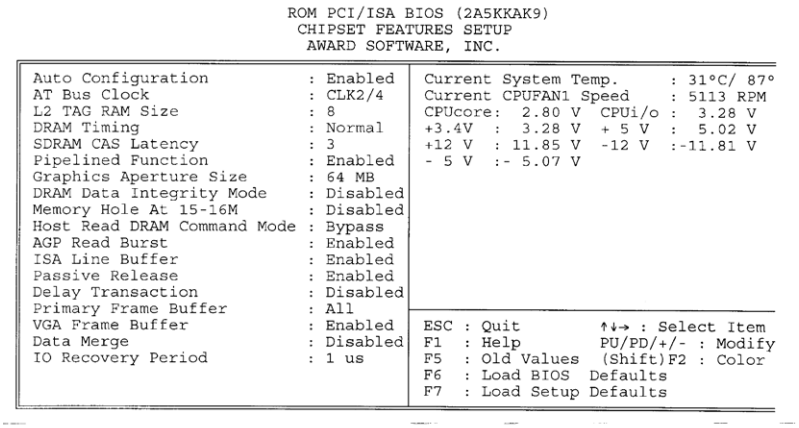
When finished press ' ESC ' to go back to the Main Menu.

3. Select 'BIOS FEATURES SETUP' enter the parameters as shown below:


ROM PCI/ISA BIOS (2A5KKAK9)
BIOS FEATURES SETUP
AWARD SOFTWARE, INC.
Virus Warning : Disabled
CPU Internal Cache : Enabled
External Cache : Enabled
Quick Power On Self Test : Disabled
Boot From LAN First : Disabled
Boot Sequence : C,A,SCSI
Swap Floppy Drive : Disabled
Boot Up Floppy Seek : Enabled
Boot Up NumLock Status : On
Boot Up System Speed : High
Gate A20 Option : Fast
Typematic Rate Setting : Disabled
Typematic Rate (Chars/Sec) : 6
Typematic Delay (Msec) : 250
Security Option : Setup
PCI/VGA Palette Snoop : Disabled
OS Select For DRAM > 64MB : Non-OS2
Report No FDD For WIN 95 : Yes
Video BIOS Shadow : Enabled
C8000-CBFFF Shadow : Disabled
CC000-CFFFF Shadow : Disabled
D0000-D3FFF Shadow : Disabled
D4000-D7FFF Shadow : Disabled
D8000-DBFFF Shadow : Disabled
DC000-DFFFF Shadow : Disabled
Cyrix 6x86/MII CPUID: Enabled
ESC : Quit
F1 : Help
F5 : Old Values
F6 : Load BIOS Defaults
F7 : Load Setup Defaults
↑↓→ : Select Item
PU/PD/+/- : Modify
(Shift)F2 : Color

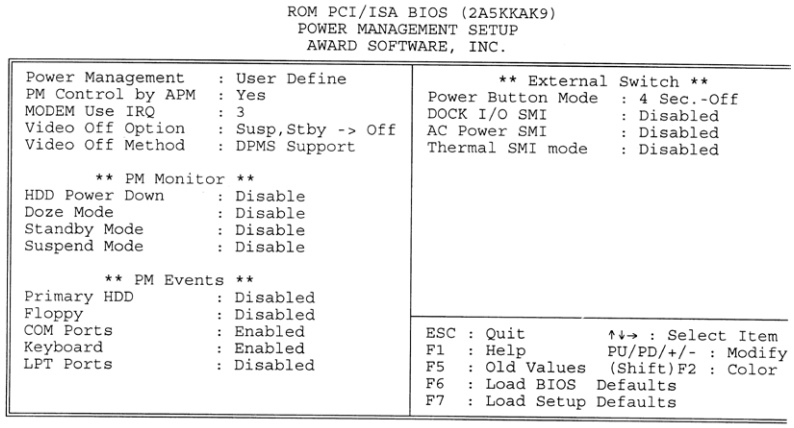
When finished introducing the data, press 'ESC' to return to the Main Menu.

4. Select ‘CHIPSET FEATURES SETUP‘ and enter the parameters as shown below:

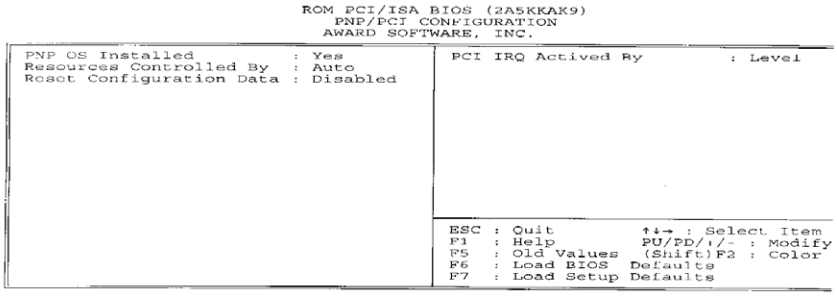

ROM PCI/ISA BIOS (2A5KKAK9)
CHIPSET FEATURES SETUP
AWARD SOFTWARE, INC.
Auto Configuration : Enabled
AT Bus Clock : CLK2/4
L2 TAG RAM Size : 8
DRAM Timing : Normal
SDRAM CAS Latency : 3
Pipelined Function : Enabled
Graphics Aperture Size : 64 MB
DRAM Data Integrity Mode : Disabled
Memory Hole At 15-16M : Disabled
Host Read DRAM Command Mode : Bypass
AGP Read Burst : Enabled
ISA Line Buffer : Enabled
Passive Release : Enabled
Delay Transaction : Disabled
Primary Frame Buffer : All
VGA Frame Buffer : Enabled
Data Merge : Disabled
IO Recovery Period : 1 us
Current System Temp. : 31°C/ 87°
Current CPUFAN1 Speed : 5113 RPM
CPUcore: 2.80 V CPUi/o : 3.28 V
+3.4V : 3.28 V + 5 V : 5.02 V
+12 V : 11.85 V -12 V :-11.81 V
- 5 V :- 5.07 V
ESC : Quit ↑↓→ : Select Item
F1 : Help PU/PD/+/- : Modify
F5 : Old Values (Shift)F2 : Color
F6 : Load BIOS Defaults
F7 : Load Setup Defaults

When finished introducing the data, press ‘ ESC ‘ to return to the Main Menu.

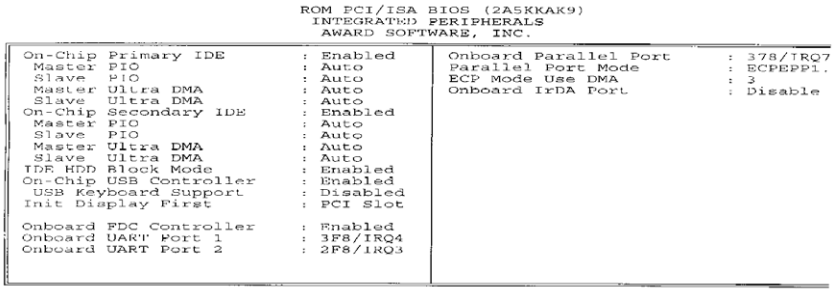
5. Select ‘POWER MANAGEMENT SETUP‘ enter parameters as shown below:
When finished introducing the data, press ‘ ESC ‘ to return to the Main Menu.


ROM PCI/ISA BIOS (2A5KKAK9)
POWER MANAGEMENT SETUP
AWARD SOFTWARE, INC.
Power Management : User Define
PM Control by APM : Yes
MODEM Use IRQ : 3
Video Off Option : Susp,Stby -> Off
Video Off Method : DPMS Support
** PM Monitor **
HDD Power Down : Disable
Doze Mode : Disable
Standby Mode : Disable
Suspend Mode : Disable
** PM Events **
Primary HDD : Disabled
Floppy : Disabled
COM Ports : Enabled
Keyboard : Enabled
LPT Ports : Disabled
** External Switch **
Power Button Mode : 4 Sec.-Off
DOCK I/O SMI : Disabled
AC Power SMI : Disabled
Thermal SMI mode : Disabled
ESC : Quit ↑↓→ : Select Item
F1 : Help PU/PD/+/- : Modify
F5 : Old Values (Shift)F2 : Color
F6 : Load BIOS Defaults
F7 : Load Setup Defaults

6. Select 'PNP /PCI CONFIGURATION'enter parameters as shown below:
When finished introducing the data, press ' ESC ' to return to the Main Menu.


ROM PCI/ISA BIOS (2A5KKAK9)
PNP/PCI CONFIGURATION
AWARD SOFTWARE, INC.
PNP OS Installed : Yes
Resources Controlled By : Auto
Reset Configuration Data : Disabled
PCI IRQ Actived By : Level
ESC : Quit ↑↓→ : Select Item
F1 : Help PU/PD/+/- : Modify
F5 : Old Values (Shift)F2 : Color
F6 : Load BIOS Defaults
F7 : Load Setup Defaults

7. Select 'INTEGRATED PERIPHERALS' enter parameters as shown below:
When finished introducing the data, press ' ESC ' to return to the Main Menu.


ROM PCI/ISA BIOS (2A5KKAK9)
INTEGRATED PERIPHERALS
AWARD SOFTWARE, INC.
On-Chip Primary IDE : Enabled
Master PIO : Auto
Slave PIO : Auto
Master Ultra DMA : Auto
Slave Ultra DMA : Auto
On-Chip Secondary IDE : Enabled
Master PIO : Auto
Slave PIO : Auto
Master Ultra DMA : Auto
Slave Ultra DMA : Auto
IDE HDD Block Mode : Enabled
On-Chip USB Controller : Enabled
USB Keyboard Support : Disabled
Init Display First : PCI Slot
Onboard FDC Controller : Enabled
Onboard UART Port 1 : 3F8/IRQ4
Onboard UART Port 2 : 2F8/IRQ3
Onboard Parallel Port : 378/IRQ7
Parallel Port Mode : ECPEPP1.
ECP Mode Use DMA : 3
Onboard IrDA Port : Disable

After having finished to introduce the data, save by selecting the menu 'SAVE & EXIT SETUP', and press ENTER and reconfirm with 'Y' when asked.

! During start up of Windows, the BIOS may update some peripheric drivers. At the end it is suggested to block the software by pressing key "CTRL" and RE-START the analyzer.

14.5 To Install Software from CD-ROM to Hard Desk

Installation procedure:

A. Saving SW data
B. Preparation HW
C. Update SW
D. Restore HW
E. Modification set up SW

Necessary Devices: i:
- CD-R type reader " EIDE-ATAPI"
- Power supply Cable for the CD-R reader

14.5.1 TO SAVE THE SW ARCHIVES

1. Turn ON the analyzer.
2. Go to Windows desktop
3. Using the Service Disk enter “SAVEDBCHEM.EXE” to save the Methods, Controls, Standards and Profiles, presently memorized in the system.
   It is suggested to have a printed copy of the Methods, Controls, Standards, Calibrators and Profiles, programmed in the analyzer software, to avoid loo sing data in case the Service Disk has been damaged.

Proceed as described below::

4. Double click on the “Analyzer” icon present on desktop Windows
5. Enter one by one the sub-programs from the Main Menu and using “File” print the data “Print All Page”
6. Turn OFF the analyzer.

14.5.2 PREPARATION HW

! The following procedure cannot be done using CD or DVD masterizers.

1. Make sure that the Hard Disk has been preset as MASTER with the right jumpers and the CD-R reader as “Slave”.
2. Connect the CD-R reader to the flat cable.
3. Connect the power supply cord to the CD-R reader.
4. Turn ON the Analyzer
5. Press “DEL” or “CANC” to enter the BIOS setup.
6. Select “BIOS FEATURES SETUP”
7. Select “BOOT SEQUENCE”, use “PgUp” and PgDown” to select “CDROM, C, A”, then press “ESC” to return to the previous page.
8. Insert the CD-Rom with the new software version into the CD-R reader.
9. Select “SAVE and EXIT”, confirm with “Y”. Press “Enter”. The PC will execute a boot.

14.5.3 UPDATE SW

1. As soon as the boot is over, the Start Up program will be executed from the CD-R reader. During loading the following massage will be displayed: “General failure writing drive A:” press key “F” (Fail) to proceed.
2. Once the program “Drive Image” started, select “Restore Image”
3. Select “Browse”
4. Select file “XXXXX.PQI”
5. Press “OK”
6. Press “Next”
7. Select Drive C as destination to install the file.

8. On request to override the present information present on “C”, press “OK”. If requested to resize the disk , select “Automatic resize”
9. Select “Fast Mode”
10. Press “Next”
11. Press “Finish”, and wait until installation is completed
12. Select “Exit” and press “Reboot”
13. Remove the CD-Rom from the CD-R reader
14. Turn OFF the analyzer.

14.5.4 TO RESTORE HW

1. Remove the CD-R and its power supply cable.
2. Turn ON the Analyzer.
3. Press “Delete” to enter the Bios setup.
4. Select “BIOS FEATURES SETUP”
5. Select “BOOT SEQUENCE”, use “PgUp” and PgDown” to select “C, A, CDROM”, and press “ESC” to return to the previous page.
6. Select “SAVE and EXIT”, confirm with “Y”, and press “Enter”. PC executes a boot

14.5.5 TO RESTORE SW

1. When the monitor displays the first green image of Windows, press “CTRL” until all of the desktop Windows has been loaded.
2. Using Service Disk execute program “SAVEDBCHEM.EXE” to install the Methods, Controls, Calibrators, Standards and Profiles previously programmed.
3. Double click on “ Analyzer” to execute the program.

14.6 Maintenance

Remove the outside panels (see “General Maintenance“)
The below operations have to be done with Analyzer turned OFF.

14.6.1 TO REPLACE THE PC MASTER BOARD

1. Disconnect the connectors from the keyboard-mouse and the monitor.
2. Remove the two screws holding the board
3. Disconnect the flat cables from the Hard Disk and the Floppy disk-.
4. Disconnect the connectors from the serial and parallel ports.

5. Replace the board and reassemble using the operation in reverse. (Make sure that the flat cables are properly connected to the HD and the FD disks).

14.6.2 TO REPLACE THE MULTI-SERIAL BOARD

1. Disconnect the outside connector from the serial output.
2. Remove the two screws holding the board.
3. Replace the board and follow the operation in reverse.

14.6.3 TO REPLACE THE HARD DISK AND THE FLOPPY DRIVER

1. Disconnect the power supply connector (P4 HDD) and the flat cable.
2. Remove the screws that hold the plate with the HDD.
3. Remove the plate with the HDD.
4. Remove the fixing screws and replace the HDD.
5. Disconnect the power supply connector (P5 - FDD) and its flat cable.
6. Remove the two nuts that hold the FDD plate to its support.
7. Remove the screws that hold the FDD driver to its plate.
8. Replace the FDD driver and follow the assembly in reverse. (Make sure that the flat cables are properly reconnected).

14.6.4 TO REPLACE THE PASSIVE ISA BUS BOARD

1. Remove the PC board and the multi-serial board (See above)
2. Remove the six nuts that hold the passive board.
3. Replace the board following the operation in reverse.

14.7 Trouble Shooting Guide

To solve some of the Problems use the Diagnostic Program "**HUMASTAR 300 TOOLS**".

Defect	Causes and Remedies
Computer does NOT turn ON	- See „3.5 Trouble Shooting Guide". - Disconnect the HDD and FDD - Replace the computer PC board

Analyzer is ON and does INIT, but monitor does NOT display any images.	- Make sure that the monitor is connected to a power socket. - Make sure that monitor is inserted correctly to the computer PC board. - Check the output to monitor by connecting another monitor. - If the other monitor works, replace the monitor. - If no image is visualized, replace the computer PC board
During operation the analyzer RESETS itself	- Check the power supply,(see „3.5 Trouble Shooting Guide“.). - Check the configuration of the BIOS - Replace the computer PC board - Replace the passive board ISA BUS
Mouse pointer blocks itself casually.	- Replace mouse - Replace the adapter PS2 mouse - keyboard - Replace the computer PC board.
The analyzer is ON, but does NOT do INIT. After a while the Error is displayed: HARDWARE TIME OUT	- Check the power supply. (See „3.5 Trouble Shooting Guide“.) - Check the internal serial cable connection. - Using the Diagnostic Program, check individually the three Systems – Reagents, Sampling and Cuvette, to determin if the cause is the sue to the slave CPU board or the multi-serial board. - Check the the configuration of the multi-serial port - Reinstall the software via CD-ROM - Using the Diagnostic Program check the the temperature sensor of the incubation bath. The software is programmed to check this temperature before doing INIT, if this is not done, the program generates a Time-Out

Program is slow to come up.	- Make sure that the BIOS recognizes correctly the computer PC board at 233MHz-MMX and 64 Mb of memory. - Reinstall the software via CD-ROM - Replace the HDD - Replace the computer PC board
Mouse pointer works but when clicking with the left no window opens.	- Click with the right on the monitor and repeat the operation. - Click using the central roller on any point on ther monitor and repeat the operation
BIOS does NOT recognize the HDD and displays on the monitor: **DISK BOOT FAILURE.....**	- Check then the connection of power supply and the flat cable connection to the computer PC and the HDD - Enter the BIOS and select "IDE HDD AUTO DETECTION". If the program gives all ZERO (0) values, replace the HDD. - If the program recognizes the correct values, exit the BIOS and repeat boot - If the problem persists, replace the flat cable - Replace the computer PC board.
BIOS does NOT recognize the FLOPPY DISK displays on the monitor: **FLOPPY DISK FAILURE.....**	- Check then the connection of power supply and the flat cable connection to the computer PC board and to the FDD driver. - Enter the BIOS and check section "STANDARD CMOS SETUP" parameter "Drive A" it should be set to 1,44 Mb. Exit BIOS and repeat boot - If the problem persists, replace the flat cable - Replace the FDD driver - Replace the computer PC board.
Impossible to save or to read from a floppy disk	- See the remarks above - Make sure that the disk is not protected - Replace the the FDD driver.
Clock does not keep the time correctly.	- The analyzer has not been used for a long time. Leave analyzer ON for a while and check clock again, the next time you turn ON the analyzer. - Replace the computer PC board

Printer does not print, or prints strange characters.	- Make sure the printer is connected to a power socket and its switch is ON. - Check the connection of the parallel cable from the printer to the computer PC board. - Make sure the printer is ON LINE - Make sure that in OPIONS (F9) the printer is set to “PRINT ON LINE” - Make sure that the parallel port LPT1 is correctly inserted in the connector to the computer PC board. - Make sure that the printer in use has been selected in the operating software. - Update the driver of the printer in Windows - Replace the computer PC board.

14.8 Spare Part List

Code	Sub_Code		Description	QTY
AY0096.01	**17889**		Complete Assy for computer module 1° version	1
AY0199.02	**17889**		Complete Assy for computer module 2° version	1
	910.002.031		Multi-serial board	1
	17810/7		Passive board ISA-BUS	1
	910.001.005		Driver FDD	1
	17933S		Hard disk with software	1
	910.002.062		Flat Cable for HDD	1
	910.002.063		Flat cable for FDD	1
17889		●	Computer PC complete with cable	1
	910.002.062		HDD cable	1
	910.002.063		FDD cable	1
910.001.060			Keyboard	1
910.003.017			Mouse	1
FC0069.01			Multi-serial Cable	1
910.002.066			Double Cable adapter for Keyboard-mouse	1
910.004.005			Printer Cable	**1**
17990P		●	Complete Software on a CD-Rom	**1**

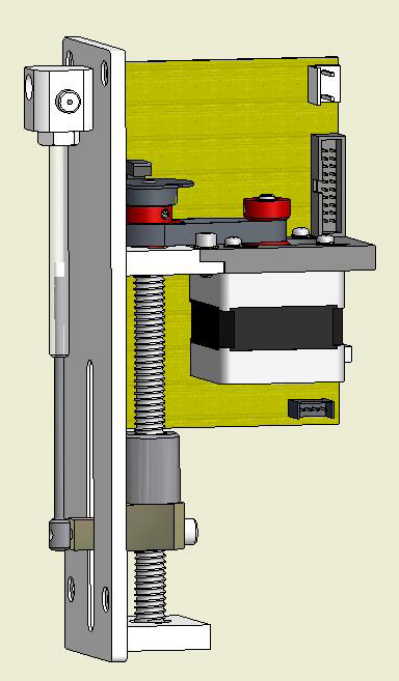
! To assure a fast and efficient technical service to the clients, HUMAN suggests to keep in stock the parts marked with (•). When ordering parts, make sure to mention: Code Number, Description and Quantity.

15 MISCELLANEOUS

In this section are described some of the modules integrated in the Analyzer.

15.1 Diluter (P/N: AY0069.05)

TECHNICAL DESCRIPTION



The Diluter module aspirates and dispenses samples and reagent by a linear movement of a highly precise syringe piston.

Each Diluter is controlled by a CPU Slave board.

The Syringe is inserted into a **"T" holder**. On one side it is connected to a peristaltic pump in order to wash the circuit after each operation, the other side is connected to the Aspiration Probe.

There are two similar Diluters in the system. One for Sample preparation and the other for Reagent aspiration and dispensing. The only difference between them is the size of their syringe:

- Sample Diluter **tipo 4** max. 600µl
- Reagent Diluter **tipo 5** max. 1000µl

15.2 Air Pump (P/N: AY0121.02)

TECHNICAL DESCRIPTION

The Air pump generates an air flow necessary to dry clean the reaction cuvettes after wash, as well as dry clean the two Probes after each operation.

Connections:

- The Air Pump is controlled by the analyzer via a socket in the back of the analyzer “AIR PUMP”.
- The air tubing is inserted into the air inlet marked “**AIR**” in the back of the analyzer.

The power plug in the air pump contains a fuse box with two fuses. The fuse box serves also to change the power supply voltage to either 115V or 220V.

DOCUMENTATION

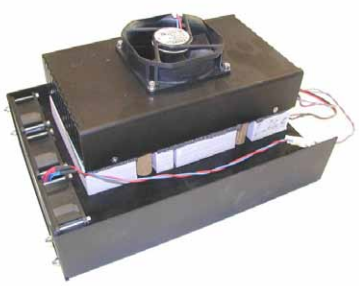
AY0121.00.0.SC	(electrical diagram)
EM0145.01.0.SC	(electrical diagram)

15.3 Cooling System (P/N: AY0115.01)

TECHNICAL DESCRIPTION

This module generates a flow of cold air inside the Reagent Chamber to keep the Reagents in their containers cool. The Reagents in the Chamber are held at a temperature of +7 to + 10°C below the ambient room temperature

The module consists of a Peltier, with two radiators and a fan system to circulate the cold air inside the Reagent Chamber and to dissipate the heat from the hot radiator surface.



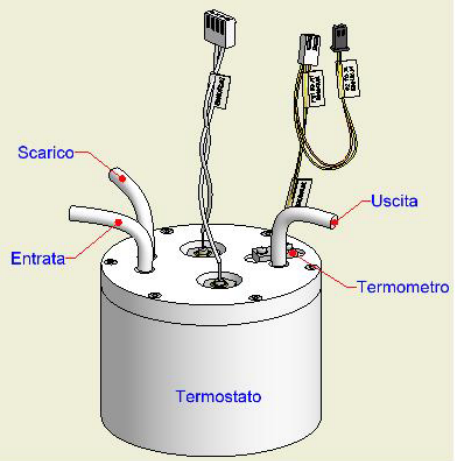
DOCUMENTATION

AY0115.01.0.SC (electrical diagram)

15.4 Thermostat (P/N: AY0131.01)

DESCRIPTION

The Thermostat heats and controls the liquid temperature inside the incubation bath to 37°C.
Liquid in the thermostat is heated by a resistance and controlled electronically by an internal temperature sensor. A linear pump (P6) circulates the liquid continuously between the thermostat and the cuvette incubation bath.



DOCUMENTATION

EA0098.01.0.SC (electrical diagram)

15.5 Maintenance

Remove the top panels. (see the procedure in “General Maintenance)

15.5.1 DILUTER

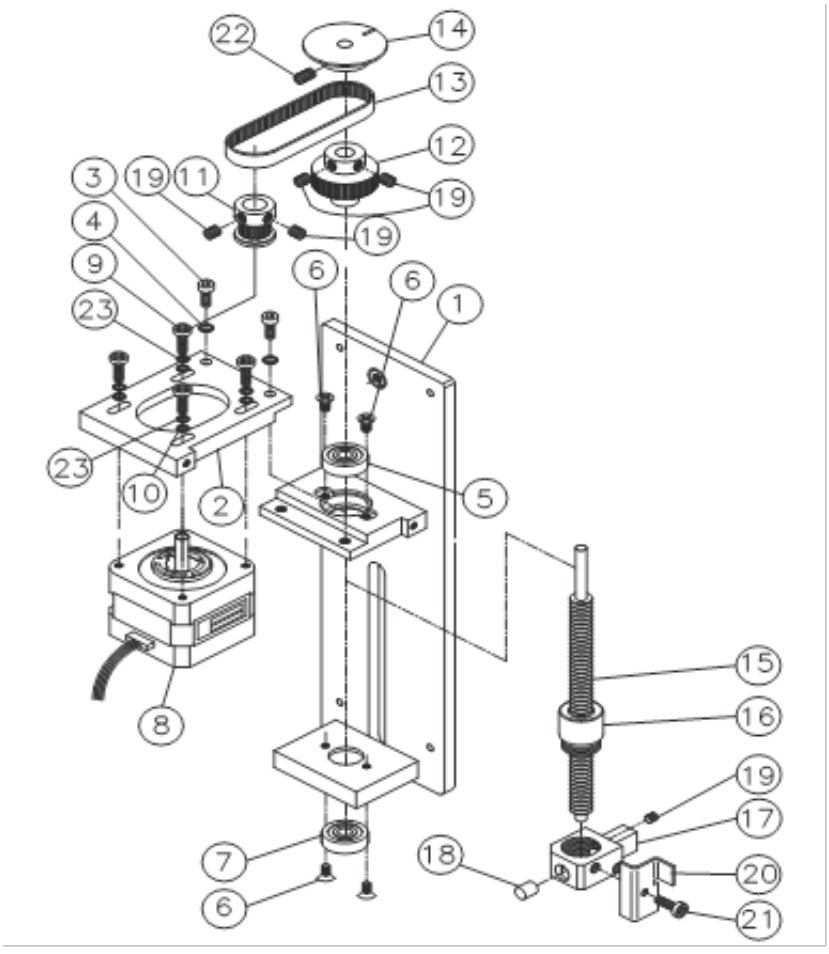
15.5.1.1 To replace the motor and the belt

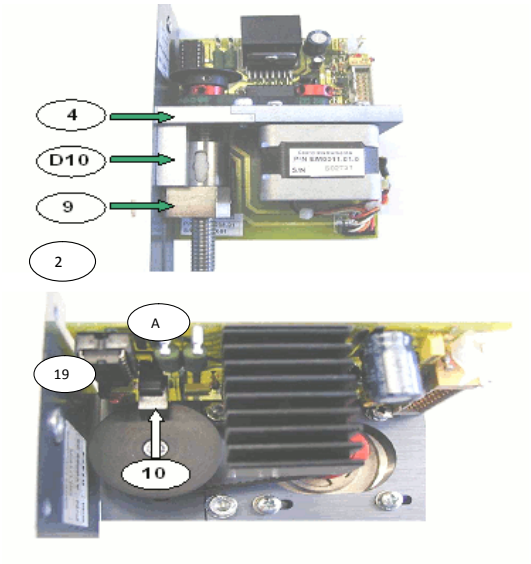
1. Remove the Syringe.
2. Remove the screws that hold the board EB0068.01 and disconnect it from the motor.
3. Loosen screws (22) and remove SYNC Disk (14)
4. Loosen screws (9) that hold the motor to its support (2).
5. Remove pulley (11) from the motor (8).
6. Replace motor (8).

! To do this operation – take out the Diluter from the Analyzer.

7. Replace belt (13), and reassemble the SYNC disk (14).
8. Remove pulley (11) and align it with the belt. Lock screws (19). Tighten slightly screws (9). Tighten the belt and lock screws (9).
9. Remove the board
10. 1Insert the spacer (D10) between the upper support (2) and the spiral housing (19) approach it by turning the pulley (11).
11. Rotate the sync disk (14) until the split is exactly in the center of the opto (A) tighten the screw (22).
12. Replace the Diluter into its place in the analyzer. Reassemble the syringe and reconnect the tubing.

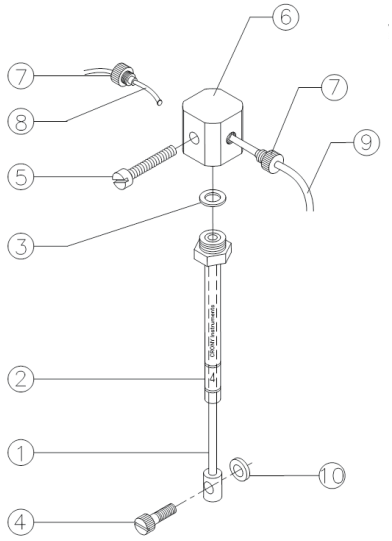
At the end, check the Diluter operation using the Diagnostic program.
Every 12 months place a few drops of very light oil on the screw (15)





15.5.1.2 To replace the Syringe

1. Remove screw (5) and knob (4) that holds the piston. Attention do not loose the isolating washer (10).
2. Unscrew the syringe (2).
3. Remove the O-ring (3)
4. Replace the syringe, make sure to reinsert the correctly the O-ring (3)
5. Remount the syringe onto the diluter. Make sure to insert the isolating washer (10) and align the piston (1). e



! Operation to be done in case of a leak, a break or badly reproducible results.

1	Piston	6	Syringe holder
2	Syringe cylinder	7	Knob holder of the teflon tubing
3	O-ring	8	Tubing to pump P1 and P2
4	Fixing screw for piston (nylon)	9	Tubing to Sampling Probe
5	Fixing screw for syringe	10	Isolating washer (nylon)

15.5.2 THERMOSTAT

! Operation to be done with Analyzer turned ON.

15.5.2.1 To empty the hydraulics of the Thermostat and incubation bath

This operation can be done using the Analyzer Maintenance (F8) or the Diagnostic Tester.exe.

- **To empty the hydraulics using the Analyzer Maintenance:**

1. Go to **Maintenance – Measurement System (F8).**
2. Click on "**Drain Liquid Bath**".
3. Click "**START**" All the liquid present in the incubation bath and the Thermostat will be drained to WASTE. This procedure takes about 2 to 3 min. and will be finished when the green light START will be ON again.
4. The analyzer can be turned OFF.

- **To empty the hydraulics using the Diagnostic Program:**

1. From desktop Windows, using the Diagnostic Service disk, go to Test.exe.
2. Activate PWR ON on all three systems – Reagent, Sampling and cuvette,
3. Click on **[TB Drain]** in section Cuvette.
4. When finished, close the program and turn OFF the Analyzer.

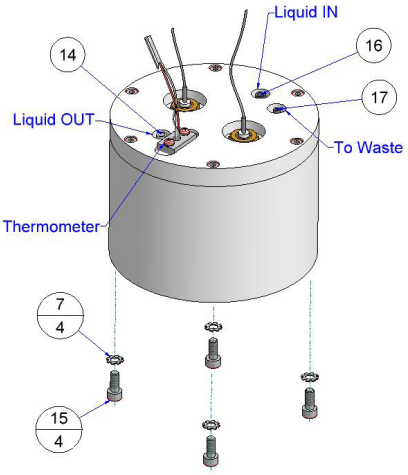
! DO NOT LEAVE the Analyzer ON and the Thermostat without liquid for more then 5 min. The heating element may overheat and create considerable damage.

During drainage the pump P6 becomes noisy when all the liquid has been drained. The noise stops at the end of the operation.

15.5.2.2 To Replace the Thermostat

! Procedure to be with Analyzer turned OFF.and the hydraulics empty.

1. Remove the hydraulic tubing (14 – 16 - 17)
2. Remove the wiring cables from the heating element connector P1 EM0052.01 from board EB0043.01 and the cable from the temperature sensor connector P2 EA0098.01 from connector J11 EB0043.01 and from connector J26 from board EB0046.01
3. Remove the fixing screws (15) and take out the thermostat module.
4. Replace the nodule and reassemble following the operaration in reverse.



15.5.2.3 Replacing the heating element

1. Follow the description above for "Replacement of Thermostat".
2. Remove the two contacts from connector P1.
3. Remove screws (11) to remove the cover (1).
4. Remove the nuts (4) that hold the heating element (2). Replace the element including the O-ring and cords.
5. Replace the cover (1), making sure to find the right reference points and close with screws (11).
6. Insert contacts into connector (diagram EA0098.01 enclosed documentation).
7. Once the thermostat is reassembled, proceed to check it as described above for "Fill Liquid Bath".

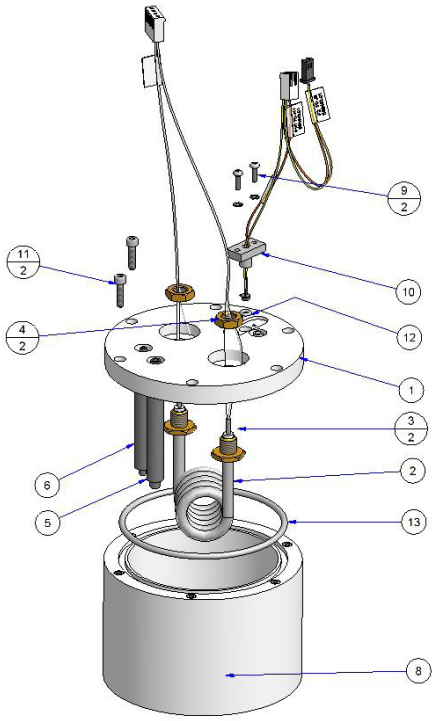


FIGURE 40

15.5.2.4 Replacing the Temperature Sensor (See figure 36)

1. Proceed to " **Drain Liquid Bath**" as desribed above and turn OFF the analyzer.
2. Remove screws (9) to remove the temperature sensor.
3. To remove the cords, remove connectors P1 and P2 from connector J11 of EB0043.01 and J26 of EB0046.01 boards.
4. Replace the sensor EA0098.01
5. Close the thermostat with screws (9) and reinsert the connectors.
6. Turn On the Analyzer and proceed to "**Fill Liquid Bath**" as described below.
7. Check the temperature inside the cuvette (with 500 ul of dist. Water) and proceed to to adjust the incubation temperature as described in "General Maintenanmce".

15.5.2.5 To Fill the Thermostat and Incubation

The filling procedure can be done using the Analyzer Maintence (F8) or the Diagnostic Tester.exe.

- **To Fill Hydraulics using the Operational program :**

1. Fill the 1liter container with plain bi-distilled water.
2. Turn ON the Analyzer
3. The start up program will fill the hydraulics automatically.

- **To Fill Hydraulics using the Diagnostic Program:**

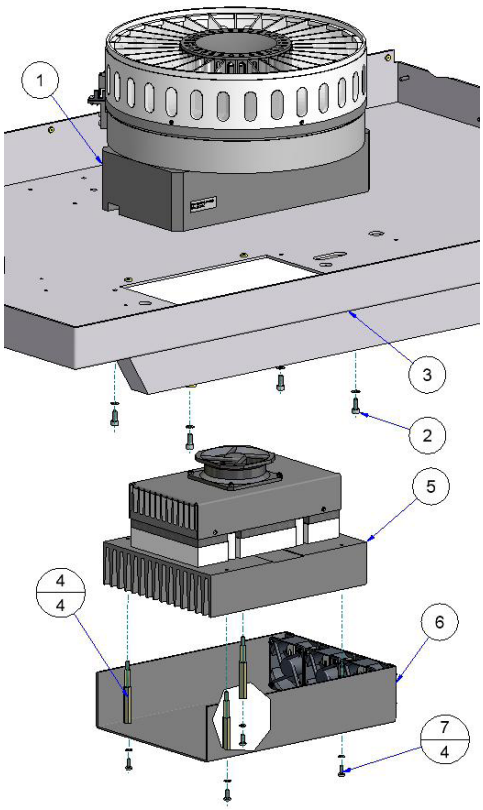
1. Fill the 1liter container with plain bi-distilled water.
2. From desktop Windows open the program Tester.exe from the Service disk
3. Turn PWR ON on all three systems (Reagents – Sampling – Cuvette)
4. Click on [TB Fill] in section Cuvette. It will be necessary to repeat the operation twice, if not necessary see „16.6 Trouble Shooting Guide“.

15.5.3 COOLING SYSTEM

15.5.3.1 Replacement of the complete Cooling System

! Procedure to be done with Analyzer rurned OFF.

1. Disconnect cable WC0085.01 on the P2 side and the power supply cable from the fans (6).
2. Remove screws (7) that hold the assembly with the fans (6) and take it out.
3. Remove screws (2) that hold the Reagent chamber (1) to the base of the analyzer (3)
4. Remove the complete Reagent Chamber (1).
5. Remove the spacers (4)
6. Replace the complete Coolong System (5) AY0115.01 and reassemble following the procedure in reverse.



15.5.3.2 To Replace the Peltier

1. Proceed as above until 4.
2. Remove screws (11) that hold the fan support (12) to the dissipator (14).
3. Raise the support (12) making sure not to demage the fan cable (8). Turn around support (12)
4. Remove screws (13) that hold the dissipator (14) to the spacers (18). Turn around the dissipator (14)
5. Remove the thermal isolator (20)
6. Remove the Peltier element (19) and clean off the thermal grease from the dissipator (14)
7. Spread new thermal grease uniformelly onto the warm side (B) of the new Peltier.
8. Place the new Peltier (19) element delicatelly onto its support (make sure to place correctly the cables): **[16 red] [17 black]**.
9. Press lightly onto the Peltier to get a uniform layer of grease underneath.
10. Place evenly thermal grease onto the warm side (A) of the new Peltier.
11. Place delicately the dissipator (14), and tighten screws (13)
12. Reassemble the Cooling System following the procedure in reverse.

Turn On the Analyzer, wait approximately 30 min. to reach its optimum working temperature.

! It is suggested to clean the dissipators every 2 years to eliminate the accummulated dust and dirt, that dimishes the efficiency of the Cooling System.

See Figure 38

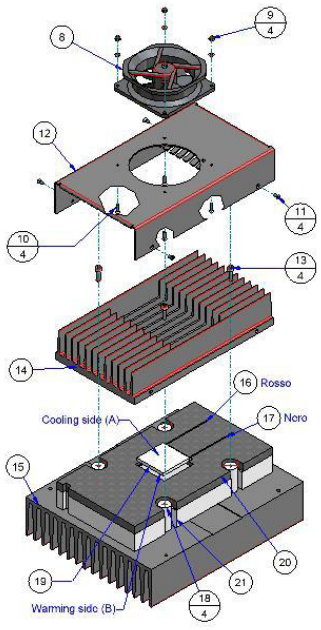
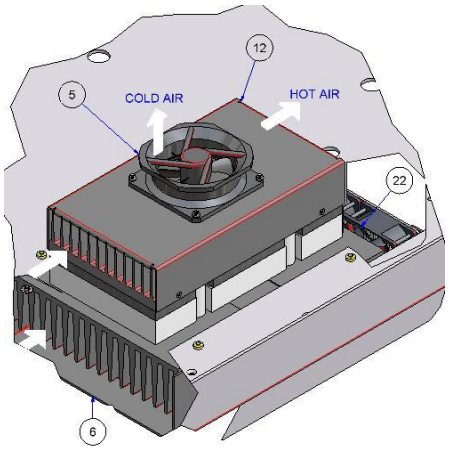


FIGURE 41

Make sure that the fan (8) inside the Reagent chamber works peoperly and cool air is pumped in the direction of the arrow. Make sure fans (22) are in operation and are pumping the hot dissipated air in the direction of the arrows.

FIGURE 42



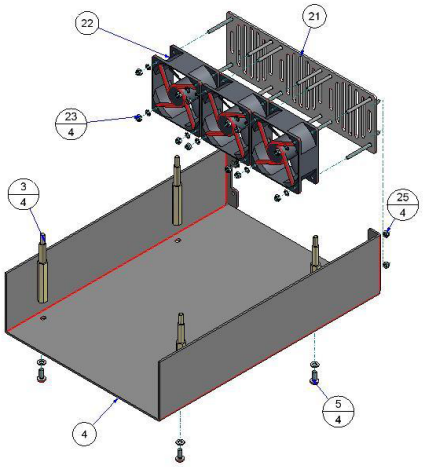
15.5.3.3 To Replace the Fans

See Figure 39

! It might be necessary to use the old power supply cable (by means of cuts and soldering) because the connectors might not being compatible.

1. Follow procedure 1 and 2 described above in „15.5.3.1 Replacement of the complete Cooling System“.
2. Remove the four nuts (25).
3. Replace the set of fans (21) with a new one Code .EA0053.02.
4. Reassemble following the operation in reverse.

FIGURE 43



! Disconnect the pump air tubing from the analyzer and disconnect its power supply.

15.5.3.4 Air pump

Remove the top panel of the air pump, by unscrewing the four screws. Remove the air pump.

15.5.3.5 Replace the Transformer

See Figure 40

1. Disconnect the power supply connector (P1) that connects the transformer to the air pump motor (4).
2. Disconnect the cables from the switch/ voltage changer (2)
3. Remove the screws that hold the transformer. (3)
4. Remove the nut holding the GND cable of the transformer.
5. Remove the nut that holds the transformer to its support. Remove the transformer.
6. Replace the transformer and reassemble following the procedure in reverse. For the cable wiring of the voltage changer switch, see Figure 41.

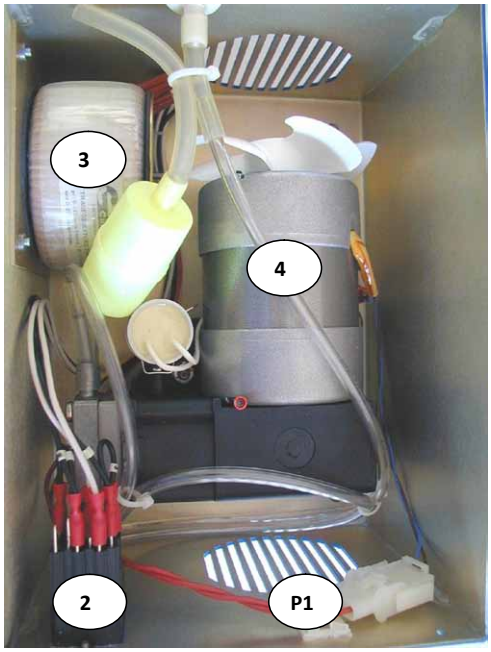


FIGURE 44

15.5.3.6 Replace the Air pump motor

See Figure 40

1. Disconnect the (P1) connector that goes from the transformer to the air pump motor.
2. Unscrew the three nuts under the container that hold the motor (4).
3. Disconnect the two PVC tubing from the pump motor.
4. Remove the motor.
5. Unscrew the three nuts (hexa) and remove the three anti-vibration supports.
6. Replace the air pump and reassemble following the procedure in reverse. Fot the correct connection of the tubing, see diagram (HY0012.01) in chapter 16 “Hydraulic System”.

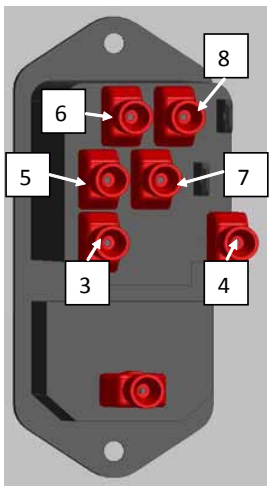


FIGURE 45

! **It is suggested to change the air filter at least one a year.**

15.5.3.7 To Replace the Air Filter

1. Disconnect the air filter from the two PVC tubing.
2. Replace the air filter and reconnect the two tubing. For detail see the diagram (HY0012.01) in chapter 16.

15.5.3.8 Replace the Fuse

Remove the power cable from the plug, remove the fuse box and replace the fuuses. For **230V - 1.25 A - Φ5x20** and for **115V - 1.6A - Φ5x20.**

15.6 Trouble Shooting Guide

To solve of the problems it will be necessary to use the Diagnostic Program "**HUMASTAR 300 TOOLS**".

Default	Causes and Remedies
Diluter does NOT work properly	- See „7.2 Trouble Shooting Guide".
Temperature in the incubation bath does NOT reach its optimum temperature.	- Wait 15 min. and repeat the temperature reading in Maintenance (F8) Cuvette System. Activate "Read Temper. (°C) - See also „3.5 Trouble Shooting Guide".
Temperature displayed on the monitor is out of range: (>43°C or < 36°C)	- Dispens 0,5ml of dist. Water into cuvette 25 and measure the temperaure inside the cuvette. (use a thermometer with a micro-probe) - If the temperature is out of its optimum range (37,1°C ± 0,1) adjust with potenziometer R26 on biard EB0043.xx - If the temperature is in range, measure with a voltmeter referred to GND on (TP1 EB0046.01), make sure that on TP6 of the slave CPU board EB0045.xx there is a voltage of 5 VDC - Regulate the temperature on the monitor using the triimmer PR1 of CPU slave board EB0045.xx Cuvette system, do not go over the value of ± 0,1V - Make sure that valve V4 and pump P6, are not blocked. Clean and if necessary replace them.

Cooling System does NOT cool	-	See details in chapter 3.
Air Pump does NOT work.	-	See chapter 3.

15.7 Spare Part List

Code	Sub_Code	Description	QTY
17915/17916		Diluter Module	1
	17970/11	Electronic board	1
	EM0011.01	Motor	1
	MS0551.01	Sphere screw(order together with 218.230.210)	1
	218.230.210	Spiral nut for screw(order together with MS0551.01)	1
	218.152.068	Syringe belt	1
AY0121.02		Air Pump	1
	756.040.015	Pump motor	1
	EM0145.01	Power supply transformer	1
	615.020.105	Input socket	1
	680.011.212	Fuses 5x20 1,25A for 230Vac	2
	680.010.216	Fuses 5x20 1,6A for 115Vac	2
AY0115.01		Complete Cooling Module	1
	EA0072.01	Peltier device complete with fan	1
	EA0053.02	Fan assembly	1
AY0131.01		Complete Thermostat assembly	1
	EM0052.01	Heating element	1
	EA0098.01	Temperature sensor	1
MA0064.01		● Syringe complete - 500 µl (1)(2)(3)(6) fig. 13.5-2	1
MA0064.02		● Syringe complete – 1000 µl (1)(2)(3)(6) fig. 13.5-2	1
	17917	Syringe holder	1
	17915/1	Syringe with piston - 500 µl (1 and 2) fig. 13.5-2	1
	17916/1	Siringe with piston - 1000 µl (1 and 2) fig. 13.5-2	1
	17915/2	O-ring	1
MS1071.01		Piston fixing knob	1
MS1072.01		Isolation washer	1

! To assure a rapid and efficient technical service to the clients, HUMAN suggests to keep in stock the parts marked with (•). When ordering parts do not forget to mention: Code Number, Description and Quantity.

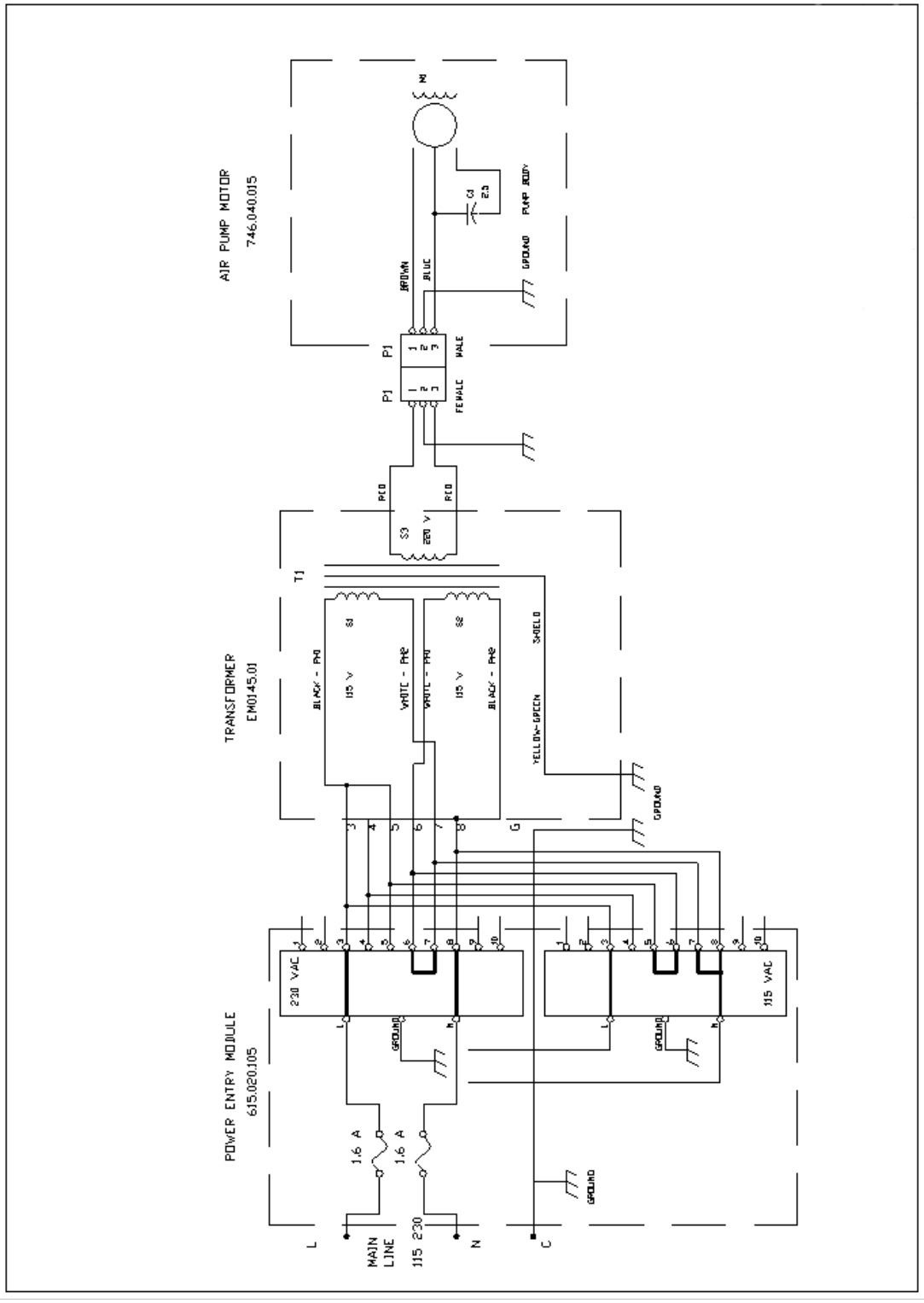
15.8 Enclosed Documentation

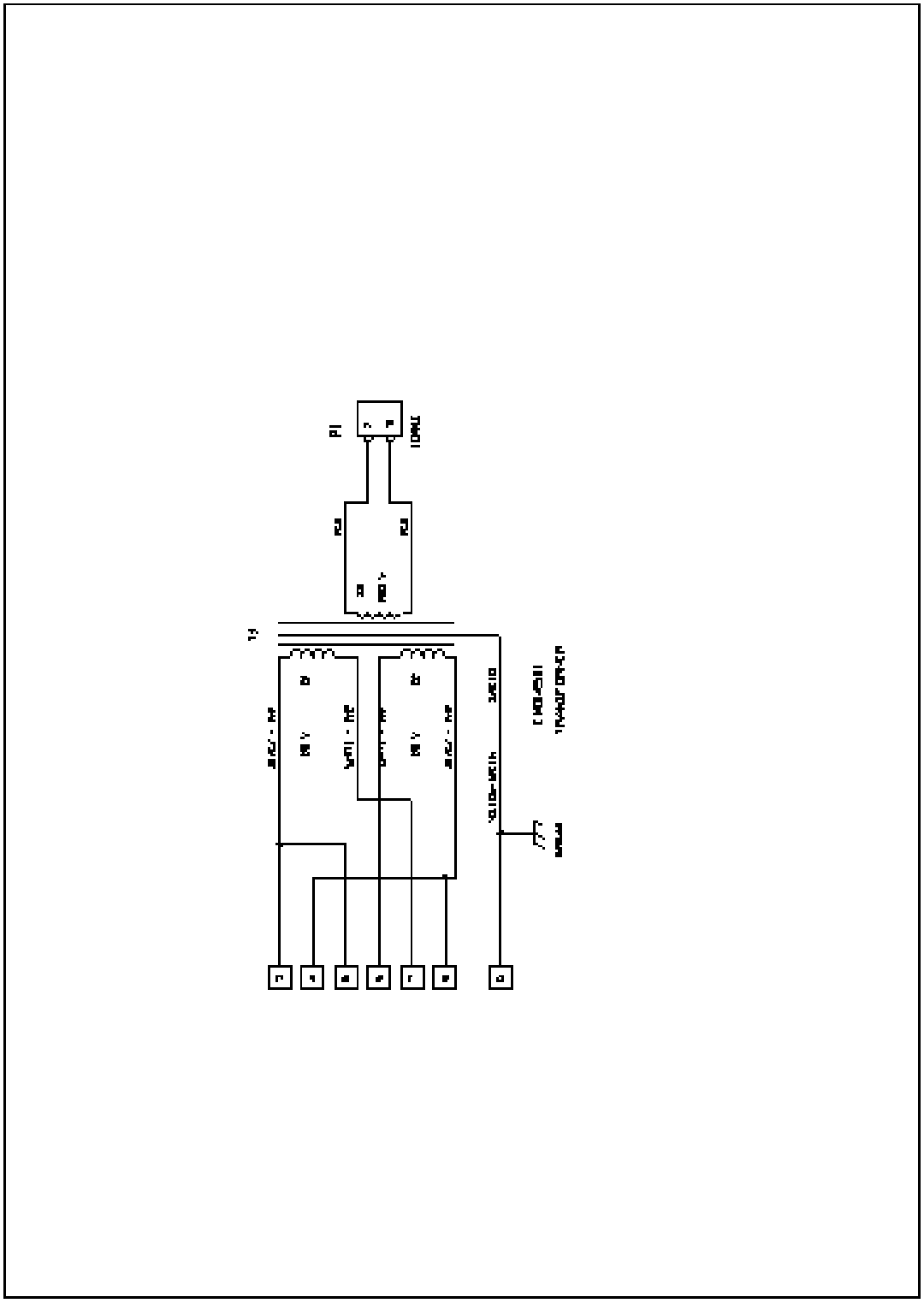
15.8.1 AY0121.00.0.SC (ELECTRICAL DIAGRAM)

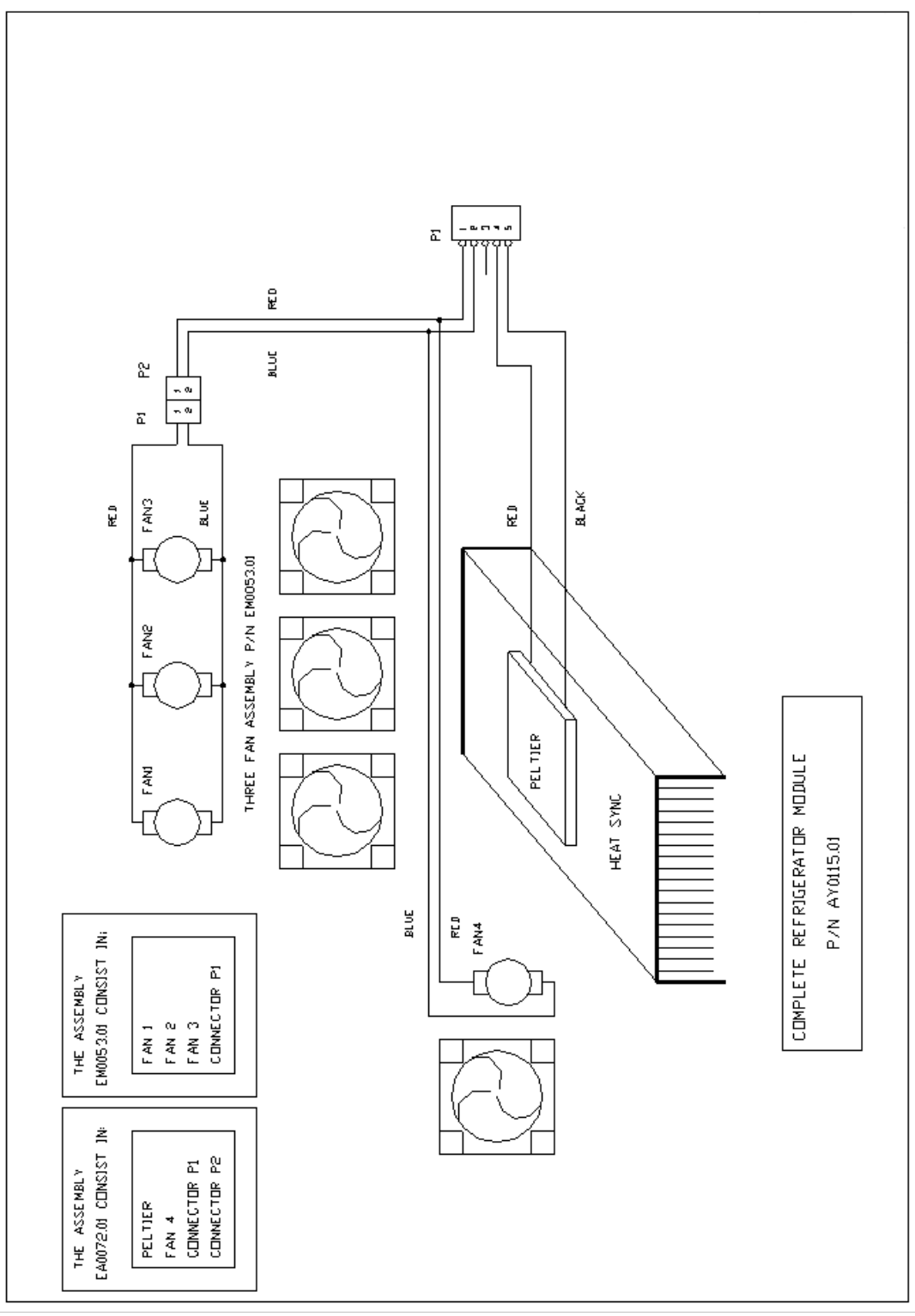
15.8.2 M0145.01.0.SC (ELECTRICAL DIAGRAM)

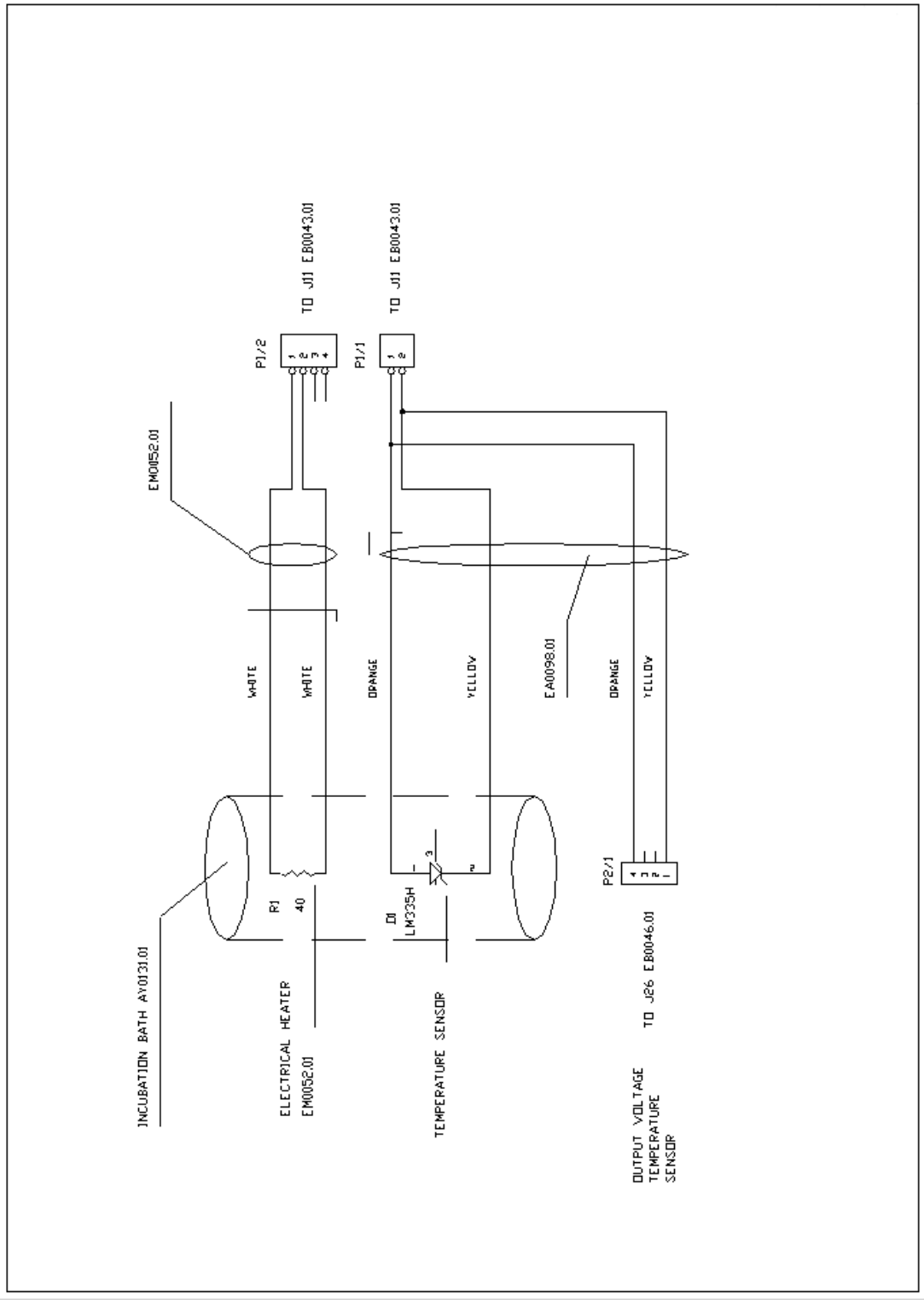
15.8.3 AY0115.01.0.SC (ELECTRICAL DIAGRAM)

15.8.4 EA0098.01.0.SC (ELECTRICAL DIAGRAM)


AIR PUMP MOTOR
746.040.015
TRANSFORMER
EM0145.01
POWER ENTRY MODULE
615.020.105
230 VAC
115 VAC
1.6 A
1.6 A
MAIN LINE
115 230
L
N
G
GROUND
BROWN
BLUE
PUMP READY
MALE
FEMALE
220 V
115 V
BLACK - PRI
WHITE - PRI
YELLOW-GREEN
SHIELD




THE ASSEMBLY
EA0072.01 CONSIST IN:
PELTIER
FAN 4
CONNECTOR P1
CONNECTOR P2
THE ASSEMBLY
EM0053.01 CONSIST IN:
FAN 1
FAN 2
FAN 3
CONNECTOR P1
THREE FAN ASSEMBLY P/N EM0053.01
FAN1
FAN2
FAN3
FAN4
P1
P2
RED
BLUE
BLACK
PELTIER
HEAT SYNC
COMPLETE REFRIGERATOR MODULE
P/N AY0115.01


P1/2
TO J11 EB0043.01
P1/1
TO J11 EB0043.01
EM0052.01
WHITE
WHITE
ORANGE
YELLOW
EA0098.01
ORANGE
YELLOW
P2/1
R1
40
D1
LM335H
INCUBATION BATH AY0131.01
ELECTRICAL HEATER
EM0052.01
TEMPERATURE SENSOR
OUTPUT VOLTAGE
TEMPERATURE
SENSOR
TO J26 EB0046.01

16 HYDRAULIC SYSTEM (P/N: HY0012.01)

TECHNICAL DESCRIPTION

To simplify the description and facilitate to identify the devices in diagram (HY0012.01), the explanation of the hydraulics has been divided into four parts. Some components will have numbers in parenthesis [ ] which are referred to diagram (HY0012.01).

16.1 Hydraulics of the Sampling System

The Sampling System is divided into:

1. Sample preparation

- Pump **P1 (17930)**: is connected in series to the sample syringe, which fills the circuit with Washing Solution and wash the whole circuit including the inside of the probe, after each operation.
- Pump **P4 (17930)**: washes the sampling probe externally after each operation.
- AIR Pump **(AY0121.02)**: dries the sampling probe externally.
- Washing device **[55]**: where the probe dips in to be washed internally **(P1)**, and externally **(P4)** and dried by the **AIR pump**.

2. Reagent dispensing System

- Pump **P2 (17930)**: connected in series to the Reagent syringe, which fills the circuit with Wash Solution and washes the circuit including the inside of the probe after each operation.
- Pump **P4 (17932)**: washes the probe externally.
- AIR pump **(AY0121.02)**: dries the probe externally
- Washing device **[55]**: where the probe dips to be washed internally **(P2)**, and externally **(P4)** and dried by the by the **AIR pump**.

16.2 Hydraulics of the Incubation Bath

Consists in:

- Thermostat **[66]** **(AY0131.01)**: heats the liquid in the thermostat and maintains the solutions in the cuvettes at a temperature of 37 C°. Pump **P6 (17941/1)** and valve **V4 (17940)** circulate the liquid continuously inside the incubation bath.
- Incubation chamber **[65]**: inside is the moving cuvette plate that is both incubated and measured.

16.3 Hydraulics of Washing and Drying the Cuvettes

Consists in:

- Pump **P5 (17931)**: dispenses Wash Solution into the cuvettes.
- Pump **P8 (17937)**: aspirates the Wash Solution from the cuvettes.
- Pump **P3 (17937)**: aspirates the residues of liquid inside the cuvettes.
- AIR pump **(17904P)**: pumps air into the cuvettes to dry them
- Washing Arm complete with Probe **(17936)**.

16.4 Waste Hydraulics

Consists in:

Pump **P7 (17937)**: empties the waste receptacle **WASTE [64]**.
Pump **P3 (17937)**: aspirates the residue inside the cuvettes.
Pump **P8 (17937)**: aspirates the Washing Solution inside the cuvettes.
Valve **V5 (17940)**: in series with Pump **P8**, when activated empties the thermostat and the incubation bath into the container **WASTE [61]**.

DOCUMENTATION

HY0012.01.D.CM	**(Hydraulic diagram pag. 1 out of 4)**
HY0012.01.D.CM	**(Hydraulic diagram pag. 4 out of 4)**
HY0012.01.D.CM	**(part list pag. 2 out of 4)**
HY0012.01.D.CM	**(part list pag. 3 out of 4)**

In the next section is described the maintenance operation of the parts described in section 14.1 ÷ 4, with the exception of Thermostat and the AIR pump. For details on those two items see section 13.

16.5 Maintenance

! Operations described in this section have to be done with Analyzer turned OFF.

Remove the outside covers of the analyzer: (see section „18 Maintenance“).

16.5.1 GENERAL RULES

For maintenance both ordinary and special, please refer to the “General Maintenance” in this section as Preventive Maintenance.
For a proper operation of the Analyzer the following maintenance operation have to be done:

- Replace all peristaltic pump tubing, change photometer lamp, change sampling syringe.

- Clean the incubation bath and the thermostat as described in the maintenance Table.
- Check the recycling inside the incubation bath, pump P6 and Valve V4. Make sure that both the filling and the drain of the incubation bath are done properly within the 2 to 3 min, if necessary change the water filter at the entrance to pump P6.

16.5.2 PERISTALTIC PUMPS

16.5.2.1 Replacement of a peristaltic pump

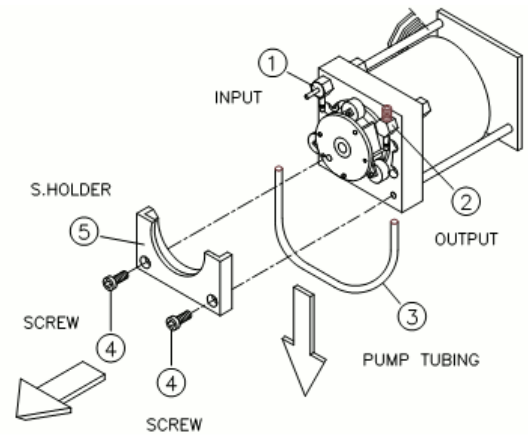
1. Remove screws (7) Fig. 40.
2. Disconnect the tubing
3. Disconnect the flat cable and the power supply
4. Replace and reassemble the same way. To connect the tubing follow the diagram (HY0012.01)

! Operations to be done with analyzer turned OFF.

16.5.2.2 Replacement of tubing in the peristaltic pump

1. Loosen the screws (4) Fig. 40.
2. Remove the tubing holder (5).
3. Replace the tubing (3) and reassemble.

! Procedure for the pumps assembled next to the Diluters. (all pumps rotate anticlockwise).



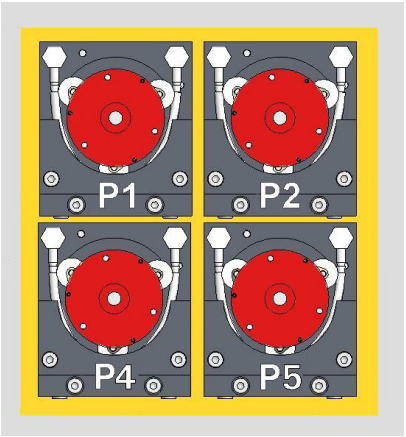


FIGURE 46

16.5.2.3 Volume setting in pump (cuvette washing)

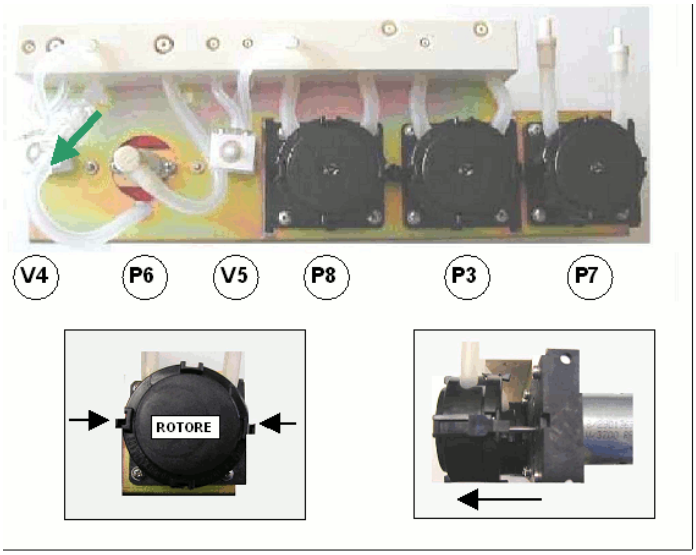
Turn ON the analyzer and load the Diagnostic Test Program.

1. Remove tubing [16] from the washing Probe and place it into a 100 ml graduated cylinder.
2. Click on [**PWR ON**] reaction cuvette section.
3. Click on [P5] [|] to start pump and check the time to fill 50 ml of water.
4. To change the pump volume, remove the pump (see above Replacement of a Peristaltic Pump) and adjust the potentiometer PR2 (board EB0033.01). To increase turn clockwise. Reassemble the pump and verify the new pump setting.

When checking or replacing the tubing, make sure that the volume pumped is set to 50 ml of water in 90 sec ± 2 sec.

16.5.2.4 Pump and Valve Assembly (Manifold)

FIGURE 47



16.5.2.5 Replacement of the Pump Rotor P3 - P7 - P8

! The procedure is the same for all 3 pumps. The rotation is anticlockwise.

1. Detach the two pump tubing from the manifold, press simultaneously the clips on the side of the rotor and remove it from the motor axis. („Figure 41“).
2. Insert the new rotor and press until the clips click. (Note: replace the rotor with an original part including its tubing P/N: 17933/3).
3. Reatach the pump tubing.

16.5.2.6 Replace the water filter on pump P6

1. Drain the incubation bath, see „15.5.2.1 To empty the hydraulics of the Thermostat and incubation bath“.
2. Detach the input and output of the filter.
3. Replace the filter. (Note: pay attention to the direction of the arrow printed on the filter „Figure 42“.)

16.5.2.7 Replace Valves V4 and V5

The first part of this procedure has to be done with analyzer ON.

1. Drain the incubation bath, see „15.5.2.1 To empty the hydraulics of the Thermostat and incubation bath“.
2. Remove the tubing.
3. Remove the three screws that hold the pump support to the analyzer base.
4. Remove the clip that holds the valve to its magnetic part.
5. Rotate the assembly 90° and remove the tubing from the valve
6. Replace the valve proceeding in reverse. To connect the tubing refer to the hydraulic diagram (HY0012.01)

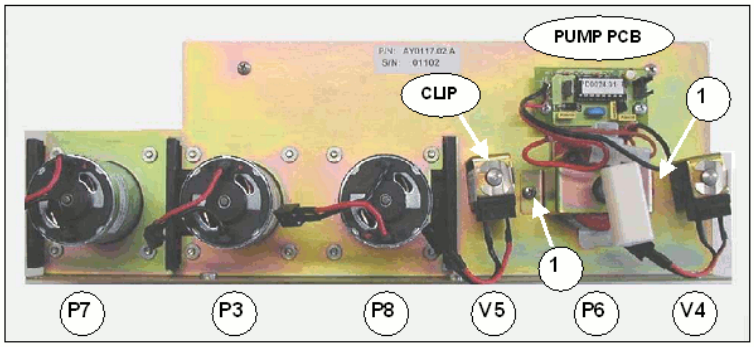


FIGURE 48

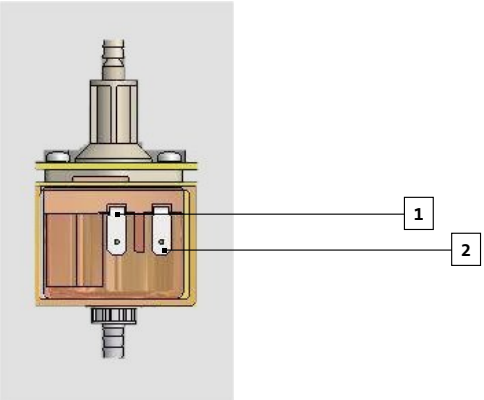
16.5.2.8 Replace Pump P4

Drain the incubation bath. See „15.5.2.1 To empty the hydraulics of the Thermostat and incubation bath“.

1 Red cable

2 Black Cable

1. Disconnect the two power terminals (type faston).
2. Remove the pump tubing.
3. Remove the two screws (1) that hold the pump („Figure 42“).
4. Take out the pump and replace it.
5. Reassemble.



The pump coil is polarized, pay attention when connecting the two terminals. See the image on the side.

16.5.2.9 Replacement of pump motors P3 - P7 - P8

1. Disconnect the two tubing from the manifold and remove the pump rotor.
2. Remove the three screws that hold the pump support to the analyzer base, and rotate them 90°.
3. Remove the four screws and take out the pump motor.
4. Replace the motor and reassemble.

16.6 Trouble Shooting Guide

This section lists a series of problems and how to solve them.
To solve some of the problems it is necessary to use the Diagnostic Test Program. “**HUMASTAR 300 TOOLS**“.

Defect	Causes and Remedies
Pump P6 became very noisy	- Make sure that the tubing leading to the thermostat are full of liquid. - Make sure there are no air bubbles both inside and outside of the thermostat - Make sure that the Fill and the Drain of the incubation bath is done within its specified time. - Check the efficiency of valve V4 - Replace the water filter - Replace the pump

The time to fill the incubation chamber has increase (more then three cycles are necessary to fill)	- Check the points as above - Check the efficiency of valve V4 - Check for obstructions in the tube connectors or in the manifold tubing.
The Drain time of the incubation bath has increase. (It requires more then three cycles to drain)	- Check tubing (24) connected to the thermostat (66), at the end drainage this tubing has to be completely empty. If some residue remains, it indicates that there is an internal obstruction of the Thermostat (&&) WASTE connector. - Check the efficiency of the valve V5 - Check the efficiency of pump P8 - Check for obstructions in the tube connectors or in the manifold tubing.
Incubation bath is not filling.	- Check the intermittent ON/OFF of the green LED on board EB0122.01 - Make sure that pump P6 produces its normal humming - In absence of the humming, try to unblock the pump by hitting it slightly with an utensil. - Replace pump P6
There is a leakage from the top of the WASTE (64) receptacle.	- Check the efficiency of pump P7 - Check for obstructions in the tube connectors or in the manifold tubing
There is a water leak under the cuvette washing arm.	- Make sure that the connections of tubing (13) (16) onto the washing Probes are well inserted and don't leak.
Some liquid remains in the cuvettes after wash.	- Check efficiency of pump P8 - Check efficiency of valve V5 - Check efficiency of pump P3 and the Air Pump. - Check for obstruction in the washing Probes. - Check for obstruction in the tubing and its connections. - Check the pumping volume of washing pump (P5) = 50ml in 90 sec. ± 2

Samples are contaminated	- Check the efficiency of the cuvette washing pump P5, the washing pump to probe P4 and the Air Pump
Leak in the Sampling Probe.	- Make sure that the connection tubing-Probe is airtight. - Make sure the syringe piston is airtight. - Make sure the connections of the syringe to its holder are airtight. - Make sure pumps P1 and P2 are airtight. (tubing is well squeezed by its holder)
Liquid spills from the top of the Probe Washing Well (55)	- Check pump P4, and make sure that its speed of rotation is according to specs. (see section 8)

16.7 Spare Part List

! To assure a fast and efficient technical assistance to ones customers, HUMAN suggests to keep in stock the parts indicated with (•). When ordering parts, make sure to mention:

Code	Sub_Code	Description	QTY
17930		Peristaltic Pump Assembly P1 – P2	1
	EB0033.03	Electronic board	1
	EM0025.01	Motor	1
	MC0024.01	• Rotor pump	1
	A01120.01	• Connector IN	1
	MC0167.01	• Connector OUT	1
17932		Peristaltic Pump Assembly P4	1
	EB0033.02	Electronic board	1
	EM0023.01	Motor	1
	MC0024.01	Rotor pump	1
	A01120.01	• Connector IN	1
	A01121.01	• Connector OUT	1
17931		Peristaltic Pump Assembly P5	1
	EB0033.01	Electronic board	1
	EM0023.01	Motor	1
	MC0024.01	Rotor pump	1
	A01121.01	• Connector IN-OUT	2
AY0117.01		Pump and Valve Assembly	1
	17937	Pump P3, P7 and P8 complete with rotor	3
	17940	Valve V4 and V5	2
	17941/1	• Linear pump P6	1
	17941/11	• Water Filter	1

MS0885.01	Manifold	1
17933/3	• Rotor for pump P3 – P7 – P8	3

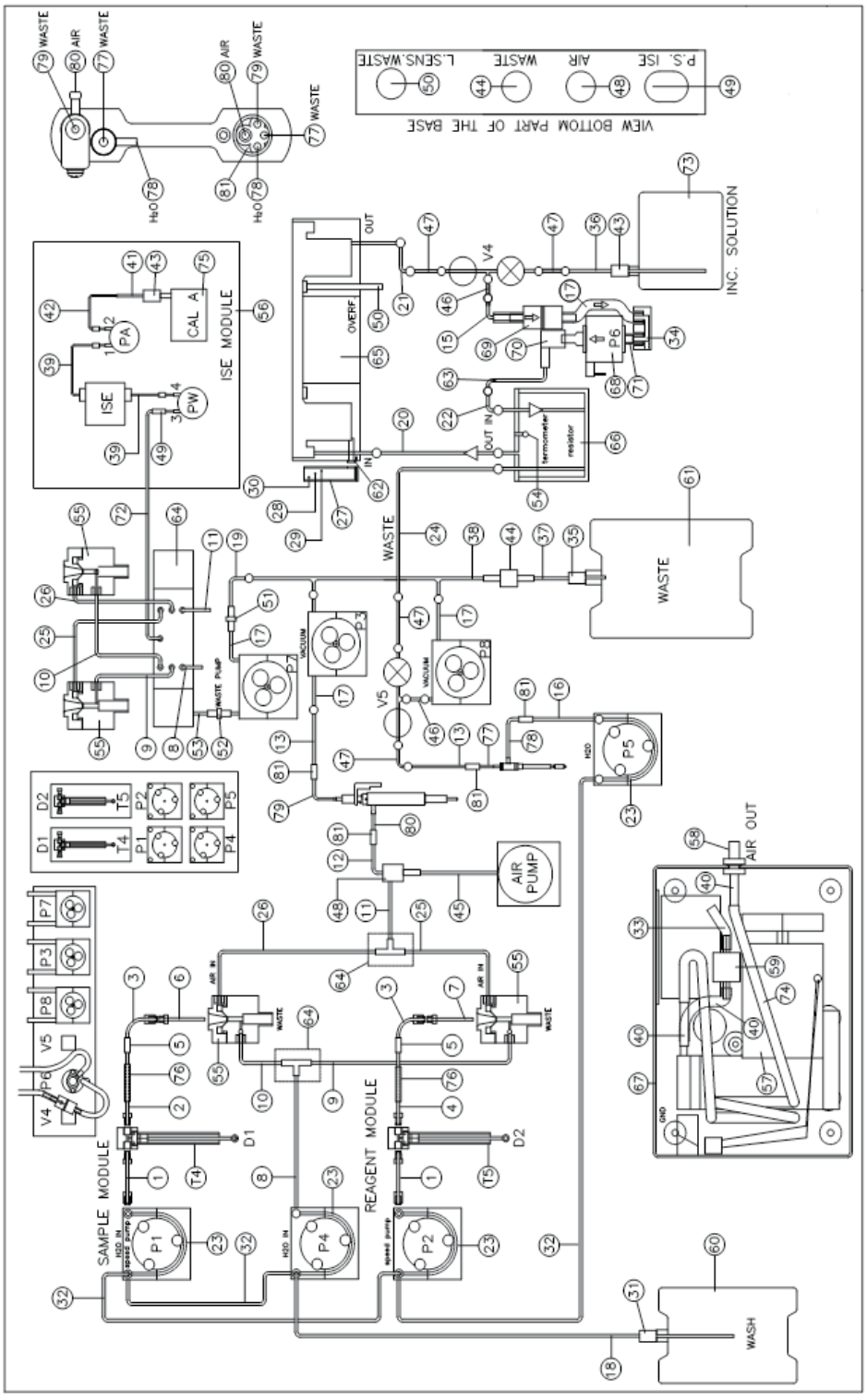
16.8 Enclosed Documentation

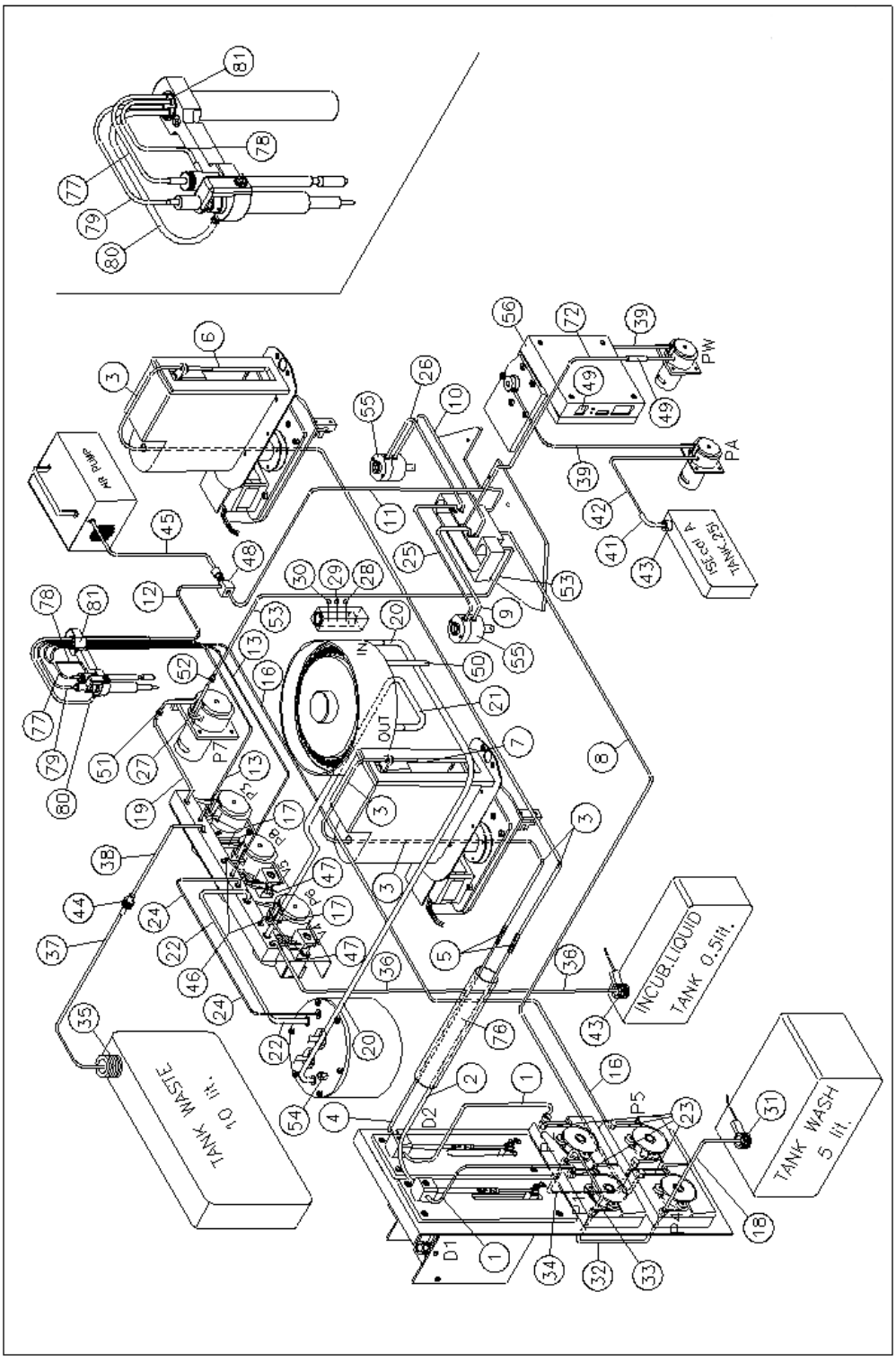
16.8.1 HY0012.01.F.CM (HYDRAULIC DIAGRAM PAGE 1 OUT OF 4)

16.8.2 HY0012.01.F.CM (HYDRAULIC DIAGRAM PAGE 4 OUT OF 4)

16.8.3 HY0012.01.F.CM (SPARE PART LIST PAGE 2 OUT OF 4)

16.8.4 HY0012.01.F.CM (SPARE PART IIST PAGE 3 OUT OF 4)


VIEW BOTTOM PART OF THE BASE
P.S. ISE
AIR
WASTE
L.SENS.WASTE
INC. SOLUTION
ISE MODULE
CAL A
ISE
PA
PW
OVERF
OUT
IN
V4
P6
termometer
resistor
WASTE
P3
P7
VACUUM
WASTE PUMP
V5
P8
P5
D2
D1
T5
T4
P2
P1
P4
AIR PUMP
AIR OUT
SAMPLE MODULE
REAGENT MODULE
H2O IN
speed pump
AIR IN
WASH
GND
H2O WASTE AIR


AIR PUMP
PW
PA
TANK 2 lit.
OUT
P7
P6
P5
P4
D2
D1
INCUB.LIQUID TANK 0.5 lit.
TANK WASTE 10 lit.
TANK WASH 5 lit.

POS.	CODE	NAME	Q.TY	TYPE	ø mm	SIZE mm	NOTE
1	TU0048.01	Pump tubing	2	TEFLON	AWG17	300	
2	TU0049.01	Diluter tubing	1	TEFLON	AWG17	1100	
3	TU0060.01	Probe tubing	2	TEFLON	AWG17	635	
4	TU0050.01	Diluter tubing	1	TEFLON	AWG17	800	
5	TU0081.01	Connection	2	SILICONE	1/3	30	
6	MC0135.01	Sample probe	1				
7	MC0135.01	Reagent probe	1				
8	TU0051.01	Washing probe tubing	1	PVC	2/4	900	
9	TU0052.01	Washing reag. probe tubing	1	SILICONE	2/4	60	
10	TU0053.01	Clean sample probe tubing	1	SILICONE	2/4	90	
11	TU0054.01	Air probe tubing	1	PVC	4/6	700	
12	TU0055.01	Air tubing	1	SILICONE	3/5	750	
13	TU0056.01	Waste tubing washing cuvette	2	SILICONE	1.5/3	600	
14							
15	TU0093.01	Tubing in filter	1	SILICONE	4/7	22	
16	TU0058.01	Washing cuvette tubing	1	SILICONE	1.5/3	1040	
17	TU0059.02	Pump tubing	4	TUBO-SIL	4/7	175	
18	TU0061.01	In water tubing	1	PVC	2/4	500	
19	TU0087.01	Waste tubing	1	SILICONE	3/5	150	
20	TU0063.01	Incubation chamber tubing	1	SILICONE	5/8	600	
21	TU0064.01	Incubation chamber tubing	1	SILICONE	5/8	330	
22	TU0065.01	Thermostat water tubing	1	SILICONE	5/8	180	
23	TU0082.01	Pump tubing	4	SILICONE	2/5	125	
24	TU0066.01	Waste termostat tubing	1	SILICONE	2/5	200	
25	TU0067.01	Air tube washing reag. probing	1	SILICONE	2/5	90	
26	TU0068.01	Air tubing washing samp. probe	1	SILICONE	2/5	80	
27	MS1003.01	Level sensor	1				
28	MS1005.01	Min level	1				
29	MS1005.01	Refer. level	1				
30	MS1005.01	Max level	1				
31	AY0125.01	Level sensor Wash solution	1				
32	TU0070.01	Water tubing	3	PVC	2/4	120	
33	TU0095.01	In filter tubing	1	SILICONE	5/8	120	
34	MS1104.01	Connection	1				
35		Level sensor Wash(not attivate)					
36	TU0071.01	Tank water incubator tubing	1	PVC-SIL.	2/4	1200	
37	TU0072.01	Waste tubing	1	PVC	5/8	1500	
38	TU0073.01	Waste tubing	1	PVC-SIL.	3/5	550	
39	TU0074.01	ISE pump tubing	2	SILICONE	1/3	200	
40	TU0088.01	Air pump connection	3	SILICONE	5/8	50	
41	TU0098.02	Calibrator ISE connection	(1)	SILICONE	1.5/3	20	

N°	CODE	NAME	Q.TY	TYPE	ø mm	SIZE mm	NOTE
42	TU0077.01	Tubo calibratore ISE	(1)	TEFLON	AWG17	850	
43	AY0036.01	Sensore di livello	1+(1)				
44	MA0131.01	Tip scarico	1				
45	TU0078.01	Tubo ingresso aria	1	PVC	8/12	1300	
46	TU0079.01	Tubo valvola	2	SILICONE	2/5	75	
47	TU0080.01	Tubo valvola	4	SILICONE	2/5	35	
48	MA0130.01	Tip aria	1				
49	MS1438.01	Raccordo in acciaio	1	AISI 316	1.5/2	15	
50	TU0114.01	Tubo scarico Over Flow	1	PVC	8/12	170	
51	MS1050.01	Giunto	1				
52	MS1073.01	Giunto	1				
53	TU0085.01	Tubo scarico	1	PVC-SIL.	5/8-4/8	580	
54	WC0097.01	Termometro	1				
55	MC0128.01	Vaschetta di lavaggio	2				
56	KG0019.01	Kit modulo Ise	(1)				
57	EM0047.01	Pompa aria	1				
58	MA0132.01	Innesto tubo aria	1				
59	756.050.005	Filtro	1				
60	MS1047.01	Tanica soluzione lavaggio	1				
61	MS1049.01	Tanica scarico	1				
62	254.010.015	O-ring	1				
63	TU0096.01	Tubo pompa	1	SILICONE	4/7	120	
64	MS0969.01	Vaschetta di scarico	1				
65	MC0123.01	Camera incubazione	1				
66	AY0131.01	Termostato	1				
67	AY0121.01	Pompa aria	1				
68	756.030.010	Pompa lineare	1				
69	756.020.082	Filtro acqua	1				
70							
71	TU0097.01	Tubo di raccordo	1	SILICONE	4/7	18	
72	TU0045.02	Tubo scarico Ise	(1)	SILICONE	1.5/3	230	
73	MS1048.01	Tanica soluzione incubatore	1				
74	TU0099.01	Tubo uscita pompa aria	1	PVC	4/6	1000	
75	161.035.005	Calibratore A				500ml	
76	TU0153.01	Tubo di protezione	1	PVC	4/6	480	
77	TU0122.01	Tubo scarico lavaggio cuvette	1	SILICONE	1.5/3	115	
78	TU0125.01	Tubo lavaggio cuvette	1	SILICONE	1.5/3	80	
79	TU0151.01	Tubo scarico lavaggio cuvette	1	SILICONE	1.5/3	130	
80	TU0152.01	Tubo aria	1	SILICONE	3/5	120	
81	MS1241.01	Raccordo tubi lavaggio cuvette	1				
82							

17 TEST PROGRAM

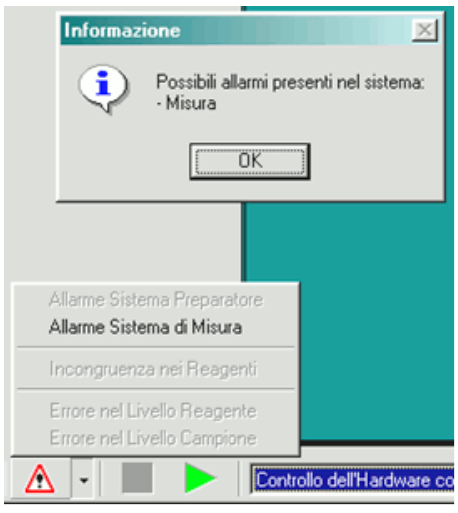
17.1 Description

The Test Program guides the technician to trouble shoot for a possible error or problem. This particular Diagnostic Program (independent of the maintenance operating program) is especially dedicated for the technical service engineer. Each analyzer part or module can be checked and tested to assure its correct operation. Ideal for a programmed maintenance as well as in routine trouble shooting for errors or breakdowns.
This program enables to check, control and verify the following functions:

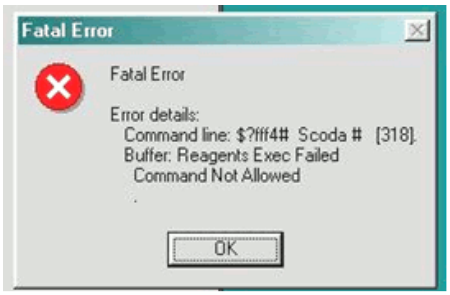
1. To fill the hydraulic circuits
2. To fill the Thermostat and Incubation Bath.
3. To align the Photometer Lamp
4. Control and alignment of modules
5. Control of the peristaltic Pumps
6. Control of the Diluters
7. Control of the Measurement System.

MESSAGES:
The analyzer generates two types of massages, one is a simple **FLAG** the other is a more serious a **Warning**:

- The Flag does not stop the analyzer, it simply notifies the operator that there is an anomaly during operation, such as missing Reagent, missing Sample, missing Wash Solution, etc. All of such massages or flags are notified by the red triangle as shown on the right. By clicking on the small arrow next to the **triangle**, a window opens to display the location of the anomaly. To identify the cause, go to Maintenance (F8) to the flagged section. A **warning** in red will be displayed against the part that caused the flag.



- The Warning of **FATAL ERROR** is a dangerous error that will automatically STOP the analyzer. Such error can be generated by both Hardware and Software, (see image on the right). The operation is interrupted and the analyzer has to be turned OFF (**after having read the message, that identified the error**). Turn back ON the analyzer and if the error persists, use the Diagnostic Program to analyze and eliminate the error.



17.2 Diagnostic Utility

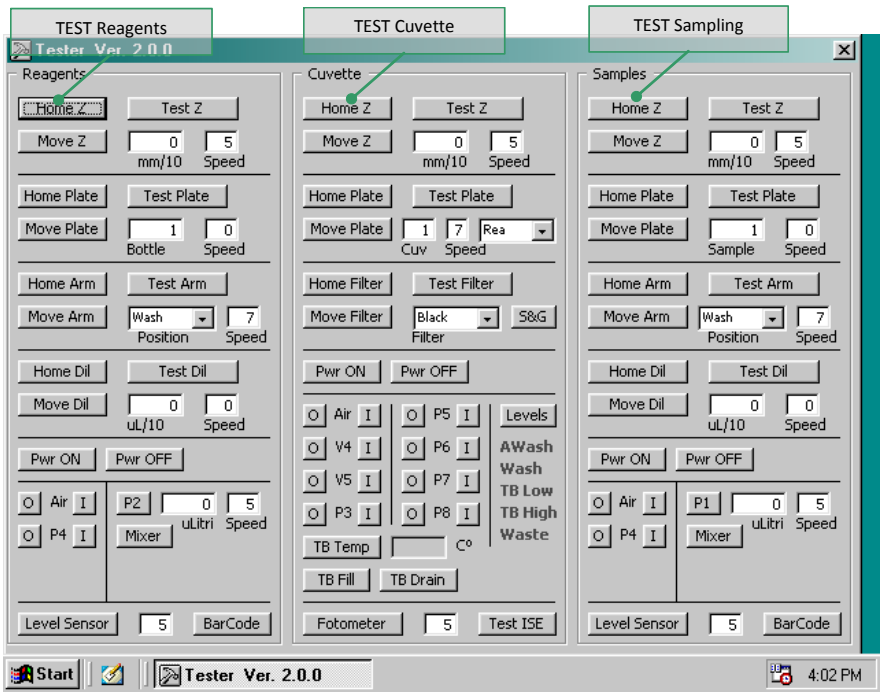
1. Turn On the analyzer and wait for booting, when the Windows (desktop) is displayed, press key “CTRL” and hold it until all of the desktop Windows has been loaded.
2. Insert diskette “**HUMASTAR 300 TOOLS**” into drive A, and proceed as follows:

- Double click on icon “floppy A“
- A window will open with the following choices: :

1. **Tester.exe**
   - Diagnostic Program
2. **PrintMeth.exe**
   - Program enables to extract ones personal data such as Methods, Profiles, Standards, Calibrators, Controls and QC memorized data from Data-Base onto a floppy diskette or to the hard disk
3. **Satsmith.exe**
   - Utility Program to enable and disable the automatic start up of Windows, to change password and to activate the Bar-code Reader
4. **SaveDbChem.exe**
   - Utility service to save and to reinstall one’s personal data, such as Methods, Standards, Controls, etc.

17.3 To Run Diagnostics using the Tester.exe

Double-click on “tester.exe” and wait for the program to be loaded, until the image below will be displayed.



The analyzer incorporates a computer PC “MASTER“ and three CPU “SLAVE “.boards.

Each of the CPU slaves, controls separately one of the below systems:

1. **Reagent System**
2. **Sampling System**
3. **Reaction Cuvette – Measuring – Cuvette Washing System**

17.3.1 IMPORTANT NOTES AND PRECAUTIONS

To simplify the use of this Diagnostic Program and to avoid errors, proceed exactly as indicated: **Improper use of the Test Program may cause damage of parts in the analyzer.**

SECURITY PRECAUTIONS: One should be very careful when using the diagnostics, especially when testing ARM movements (keep hands out)

Below are described some of the important notes that are common to many of the tests.

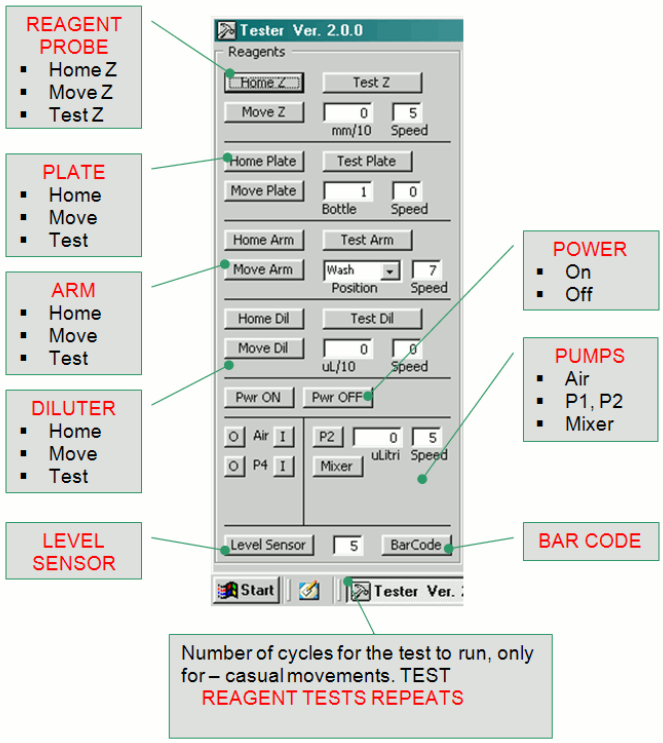
Note (1): All movements have a fixed timing for execution, beyond which they are stopped.
To repeat a test it is necessary to reactivate PWR ON.
Whenever there is a problem, such as a motor loosing steps, or finds friction or an obstacle, the system automatically disables the movement by interrupting the power supply of +24 V. The error is shown on the TESTER display on the top left.

Note (2): **Before executing a movement (Probes, Arms or plates) make sure to bring the PROBES into HOME position. The test does not control inconsistent commands.**

Note (3): If an execution of a command goes beyond the maximum allowed time, the system stops automatically. To repeat the test, first press manually RESET button on the CPU slave board controlling this particular system, thereafter **activate PWR ON**.

17.3.2 UTILITY REAGENT SYSTEM

Follow the figure:



The first operation is to activate **PWR ON** to supply +24V to the circuits, with the same command are transferred to the CPU slave, the Test parameters for the Reagent System.

IMPORTANT: The tests can be run only after all the moving parts of the Reagent System are in position HOME.

Each time a command is given, the particular name of the System becomes RED, in this case "Reagents", at the end of the test, it returns to be black.

Once a Test has been programmed, no other commands will be accepted, in any case avoid to activate other tests, not to create malfunctions.

Utility of the Reagent System

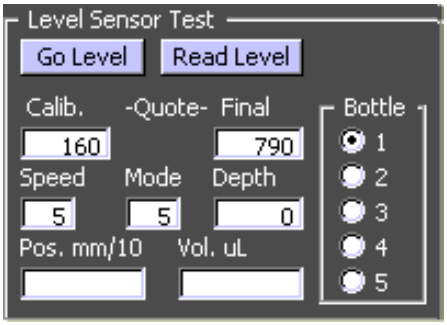
Command	Parameter	Description	Warning	(Notes) Paragraph
PWR OFF		Cuts the voltage of +24V to all modules in the Reagent System		
PWR ON		Activates the power of +24 V to all modules in the Reagent System, and loads its working parameters.		
HOME Z		Enables command HOME of Probe. If in HOME position, it will repeat the operation.		
HOME PLATE		Enables command HOME of Reagent plate. If in HOME position, i twill repeat the operation.	Before running this TEST – position the **Probe** into HOME.	(1) 16.3.1
HOME ARM		Enables command HOME of Reagent Arm. If in HOME position, i twill repeat the operation.	Before running this TEST – position the Probe and the **Reagent plate** into HOME position.	(1) 16.3.1
HOME DILUTER		Enables command HOME of Syringe piston. If in HOME position, it will repeat the operation.		(1) 16.3.1

MOVE Z	**See Warning**	Enables the command to move the Probe, starting from HOME position. Before running this test: Position the Probe and the Reagent plate to HOME Insert the parameter into the space marked: mm/10 (a tenth of a millimeter), see Warning.	**Do NOT go over its maximum** allowed Sample = max 350 Reagent = max 800 cuvette = max 590 wash = max 400 Primari tube = max 800 Predilution = max 700 module **ISE** = max 250 clean-cal.**B** = max 180	(1) (2) 16.3.1
TEST Z	**See Warnings**	The test activates a program of a casual Probe movement. in window “mm/10“, it is possible to program the number of cycles. “REAGENTS TESTS REPEATS“. Before starting this test: - Position **Probe** and **plate** into HOME. - Insert the parameter into the space marked: “mm/10“, see Warnings.	**Do NOT go over the Maximum allowed** Sample = max 350 Reagent = max 800 cuvette = max 590 wash = max 400 Primary tube = max 800 Predilution = max 700 module ISE = max 250 clean-cal.B = max 180	(1) 16.3.1
MOVE PLATE	REAG 1	The test moves the plate into the selected position. Before running this test introduce the parameter into the window marked “Position“, see parameter.	Before running this test bring Probe into Home position.	(1) 16.3.1
TEST PLATE		The Test activates a program for a random Reagent Plate movement. Into the window REAGENTS TESTS REPEATS - introduce the number of cycles.	Before running this test bring Probe and Plate into Home position.	(1) 16.3.1
TEST PLATE		The test activates a program for a random PLATE movement. In the window “mm/10“, introduce the number of cycles. “REAGENTS TESTS REPEATS“. Before running this test: Position Plate and Probe into HOME position.	Before running this test bring Probe into Home position.	(1) 16.3.1
MOVE ARM	WASH REAG # CUV #	This test activates the Reagent Arm rotation, from HOME position to the programmed position.	Before running this test bring Probe and Plate into Home position.	(1) 16.3.1

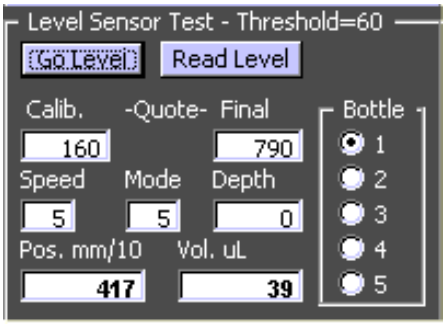
TEST ARM		This test activates a random programmed ARM rotation starting from HOME position. Enter the number of cycles into window: "REAGENTS TESTS REPEATS"	Before running this test bring Probe and Plate into Home position.	(1) 16.3.1
MOVE DILUTER	3000	This test moves the Diluter Piston, to run this test enter the volume into window: "µL / 10".	Maximum value that can be entered is 6000 µL/10.	(3) 16.3.1
TEST DILUITORE	3000	This test activates a programmed random movement of the Diluter Piston, the volume is entered in window: "µl / 10" and for a number of cycles indicated in: "REAGENTS TESTS REPEATS"..	Maximum value that can be entered is 6000 µL/10.	3) 16.3.1
AIR PUMP		To run the AIR PUMP test, activate at the same time PWR ON and AIR [|] in the Cuvette and Sampling Systems. To activate the PUMP click on key [|] To STOP the pump – click on key [O]	At the end, press key [O] to the test.	
P2 PUMP	2000	Before starting this test, enter the volume in window " µ l " (example 2000 µ l). Click on [P2] to activate the pump to dispense the programmed volume of 2000µl.	Before running this test position: HOME MOVE Arm on wash Activate pump P7 to move the liquid to Waste.	
P4 PUMP		To activate the pump,- click on key [|] To stop the pump – click on key [O]	During the execution of this test **activate** pump P7 to move the liquid to waste.	
MIXER		Click on key [MIXER] to activate the mixer (fixed time 3 sec.)		

17.3.2.1 Reagent Liquid Level Sensor

1. Dispense 40 ml of dist. Water into a container and place it into the Reagent plate in position 1.
2. Execute in succession: **[HOME Z] [HOME Plate] [HOME Arm]**.
3. Click on “Position” and select “Bottle 1“.
4. Execute **[MOVE Arm]** to position the Reagent Arm on Bottle 1.
5. Click on **[Level sensor]** see figure below.
6. Click **[Go Level]** to lower the Reagent probe into the bottle until it touches the liquid.



7. In window “Pos.mm/10“ and “Vol.µl“ are shown the values found as shown in figure below.
8. To repeat the test click on **[HOME Z]** and then on **[GO Level]**
9. Make sure that the values obtained are within:
   400 ± 30 for “**Pos.mm/10**” and ,
   and 40 ± 5 for the volume “**Vol. µl**”
10. To end the test click on the grey zone.
11. At the end of the test, click in sequence **[HOME Z]**, **[HOME Plate]** and **[HOME Arm]** to position Reagent Arm into HOME.position.



17.3.2.2 Bar Code Reader for Reagents (optional)

Note: The reader is activated for the following codes:

A) UPC/EAN
B) Code 39
C) Interleaved 2 / 5
D) Codabar
E) **Code 128 is reserved to identify the Reagent Rack.**

Follow this test - step by step:

1. Insert into the Reagent plate a bottle with a Bar Code into position 1.
2. Click on Bar-code to open the test window. See figure below.

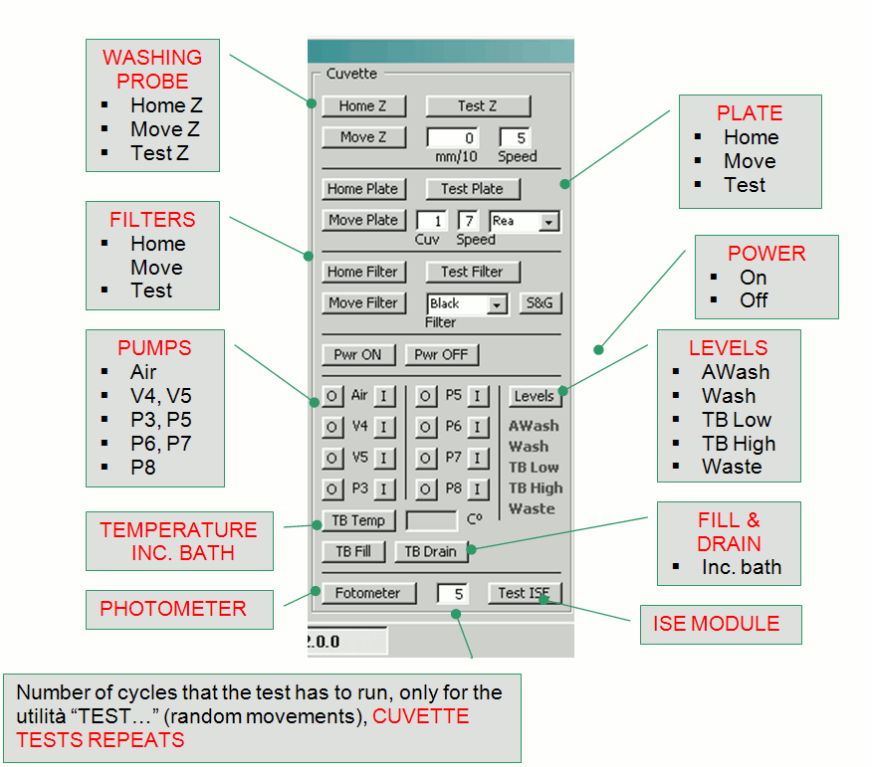
Execute [HOME Z] and [HOME Plate] .

3. Click on **[INIT]** and make sure you hear three beeps.
4. Click on **[SCAN]** and check that the number displayed in the test window corresponds to that on the bar code label.
5. In case of a wrong or missing reading, the display will indicate “NR” (no reading).
6. Click on the grey zone to end this test.

! The BAR CODE Reader uses a laser system, avoid direct contact of the beam with the eyes.

17.3.3 UTILITY REACTION CUVETTE - MEASURING SYSTEM

Follow the figure:



First of all activate **PWR ON** the +24V, the same command transfer to the Test parameters of the CPU slave Reaction Cuvette-measuting System.

During this phase, no other commando will be accepted, however avoid to activate other tests not to create malfunction.

IMPORTANT: These tests can be run only when all movements of the System are in position HOME.

Each time a command is activated – the area will become red, at the end of the Test it will return to black.

Utility Reaction Cuvette - Measuring System

Command	Parameter	Description	Warning	Note (Paragraph)
PWR OFF		Cuts power supply to the modules of the System (+24 V)		
PWR ON		Axtivates power supply +24 V to the modules of the System and loads the working parameters.		
HOME Z		Enables command HOME of the cuvette washing Probe. If it is in HOME, it repeats operation.		(1) 16.3.1
HOME PLATE		Enables command HOME of the reaction cuvette plate.	Before executing this test, bring the washing Probe to position HOME.	(1) 16.3.1
HOME FILTERS		Enables command HOME of the filter wheel		(1) (3) (4) 16.3.1
MOVE Z	355	Enables command of washing Probe. Before running this test: Insert the parameter into Test window "**mm/10**". Position HOME reaction plate.	DO NOT exceed the max. value of 355 mm/10.	(1) 16.3.1
TEST Z	355	Enables a series of random movements of the washing Probe for the number of cycles programmed in the Test window: "**CUVETTE TESTS REPEATS**". Before executing this test: Program the parameter in the Test window: "**mm/10**". Position HOME the reaction plate. The Probe moves from HOME to the programmed value in: "**mm/10**",,The number of cycles are those programmed in: "**READING TESTS REPEATS**".	Parameter"mm/10", defines the Probe movement. **DO NOT exceed the max valiue of 355 mm/10.** In case of an anomaly in operation, suggest to wait until the end of operation and repeat the HOME position of the Probe. DO NOT repeat more then 5 cycles of this test	(1) 16.3.1
MOVE PLATE		Enables the command to move the reaction plate. Before running the test: Enter into the Test window: "Cuv" the cuvette nuber (1-39)	Before executing this test bring the Washing Probe into position HOME.	(1) 16.3.1
TEST PLATE		Enables to move the reaction plate in a random movement for a number of cycles entered in Test window: "**CUVETTE TESTS REPEATS**".	Before executing this test bring the Washing Probe into position HOME.	(1) 16.3.1

MOVE FILTERS	**See warning**	Enables the CPU slave to rotate the photometer filter wheel. For this test enter the parameter into Test window " Filter ".	Position of the selected filter F1 ÷ F8 To specify the filter, see "General Maintenance" "Photometer Module".	(1) 16.3.1
TEST FILTERS		This test rotates the filter wheel in a random movement, for the number of times entered in: "**CUVETTE TESTS REPEATS**". At the end of the test, the filterbwheel stops in HOME position.		(1) 16.3.1
STOP & GO		This test enables the filter wheel and the reaction plate to run the following cycle: To activate, click on [S & GO] Il ciclo operativo comprende: 1. Position HOME filter wheel (Blank) 2. Position HOME reaction plater (cuvette 38 in front of photometer) 3. Rotates plate with cuvette 1 is in front of photometer. 4. Selects filter 7 5. Automatic measurement of ADC converter, without displaying the results. 6. Rotates plate with cuvette 2 in front of photometer 7. Selects filter 6 8. Automatic measurement of ADC converter, without displaying the results. 9..... The above operation is repeated 19 times for the reaction plate. After each plate rotation, the filter wheel position decreases by one, starting with filter 7. (Filter cycle 7, 6, 5, 4, 3, 2, 1, 8, 7, 6, 5, 4, 3, 2, 1, 8, 7, 6, 5) During the test a (beep) is heard each time a measurement is made by the ADC.converter.		
AIR PUMP		To execute the AIR PUMP test, it is necessary to activate at the same time PWR ON and AIR [|] on all three systems, Reagents, Sampling and Reactiuon cuvettes. To activate the pump, click on [|] To stop the pump, click on [O]	At the end of the test, stop the click on [O] in the rection cuvette zone.	
VALVE V4		To activate the valve, click on [|] To stop the valve, click on [O]	When activating valve V1, stop pump P6 [O]. At the end, stop the valve by clicking on [O]	

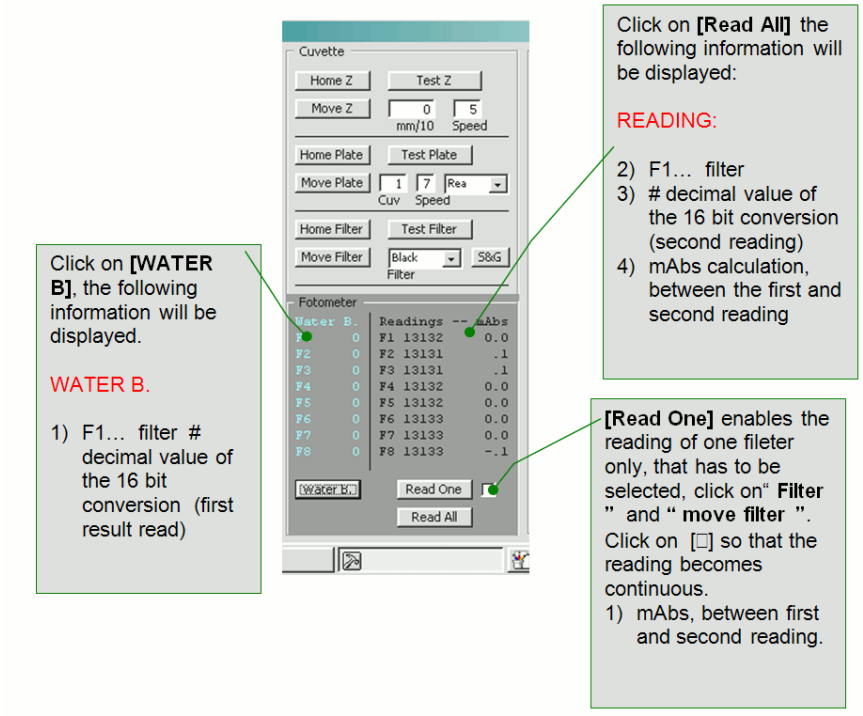
VALVE V5		To activate the valve, click on [|] To stop the valve, click on [O]	At the end, stop the valve by clicking on [O]	
P3 PUMP		To start pump click [|] To stop pump click [O]	At the end, stop the valve by clicking on [O]	
P5 PUMP		To activate pump click [|] To stop pump click [O] Before executing this test, position the Washing Arm with its Probe inside one of the cuvettes as follows: HOME plate, HOME Z Enter parameter 355 inside “mm/10“ MOVE Z Activate pump P8, by clicking on [|] to discharge the liquids to waste. At the end of the test, stop first P5 pump and then pump P8 by clicking on [O]		**(2) 16.3.1**
P6 PUMP		To activate pump, click [|] To stop pump click [O]	Activate pump P6 only when the incubation bath is full, otherwise use the function [TB Fill]	
P7 PUMP		To activate pump, click [|] To stop pump click [O]	At the end, stop the pump by clicking on [O]	
P8 PUMP		To activate pump, click [|] To stop pump click [O]	At the end, stop the pump by clicking on [O]	
TB Temp		Click on [TB Temp], the temperature is displayed on its right.	The display may vary within ± 0,5 °C	
TB Fill		To fill the incubation bath with fresh bi-dust. Water, click on [TB Fill] (it takes about 2 minuti), if necessary repeat.		
TB Drain		To emptry the incubation bath, click [TB Drain] (it takes about 2-3 minutes).		
LEVELS	AWASH WASH TB LOW TB HIGH WASTE	Click on [Levels] to update the flags, colors, (label under the key) as follows: **GREEN** -Level in the container is OK **RED -** Level in the container is below minimum. sopra il massimo Level min. water in container for incubation bath. Level min. Was Solution container Level min. of water inside the incubation bath. Level max of water inside the incubation bath Level max contenitore.		

17.3.3.1 Photometer

This test is to control:

- Lamp alignement.
- Control of filters and photometer stability.
- Control of the ADC converter

Click on **[Photometer]** a window opens below the cuvette test, as follows:



The reading scale of the converter goes from a decimal value (called count) of 0 (zero) to 65.535 (16 bit).

Items **[Read One]** and **[Read All]** will be activated **only** after having executed the command **[Water B.]**

17.3.3.2 Test ISE (optional)

This test controls the ISE module.

Click on **[Test ISE]**, after a few seconds the result will be displayed as follows:

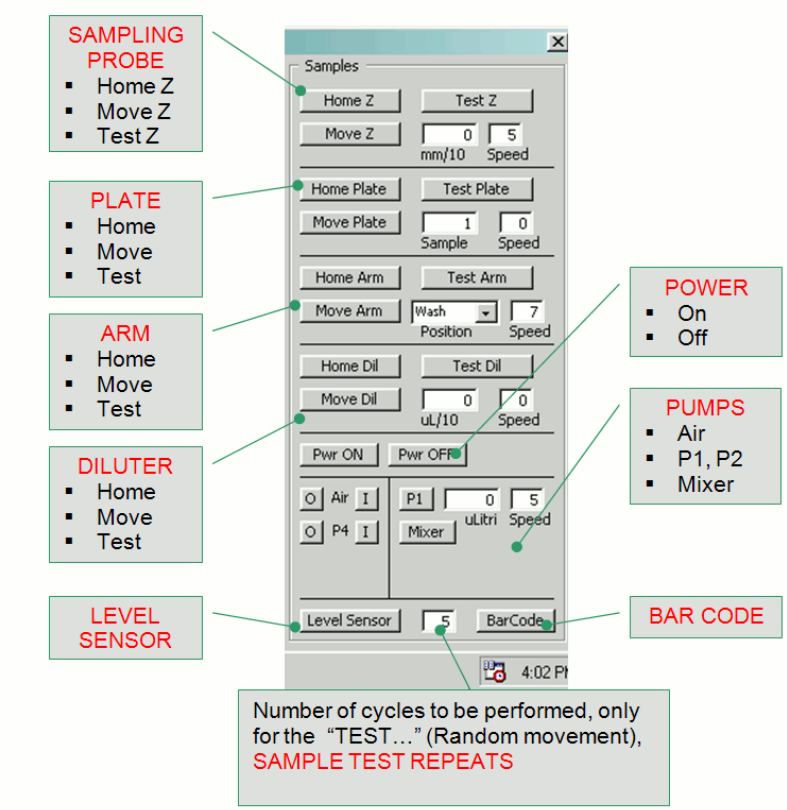
ISE module is ready

ISE module is NOT ready

For further information see „21 Optional Modules“.

17.3.4 UTILITY OF THE SAMPLING SYSTEM

For these tests see figure below:



To start, activate **PWR ON** +24V for the circuits, with that command are also transferred to the CPU slave, all the Test parameters for the Sampling System.

IMPORTANT: The tests can be run ONLY when all the moving parts are in HOME position.
Each time a command is activated – the Sysyem area "Samples" will assume a RED color, at the end of testing i twill return Black.

During this phase no othet commands are accepted. In any case avoid to activate other tests, which may create malfunctions.

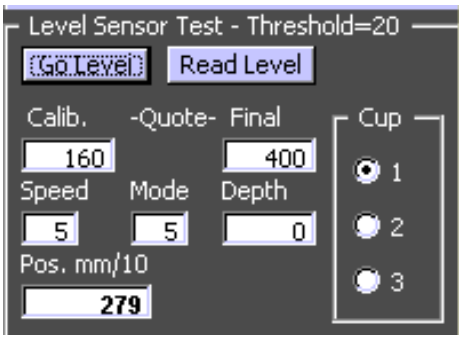
Utility of the Sample System

Command	Parameter	Description	Warnings	(Note) Paragraph
PWR OFF		Cut voltage of +24V to the Sampling System		
PWR ON		Activate the +24 V to the Sampling System, test parameters will be transferred automatically.		
HOME Z		Activate commad HOME for Probe. If it is in HOME, it will repeat the operation.		
HOME PLATE		Activate command HOME of the Sample Tray. If it is in HOME, it will repeat the operation.	Before running this test – make sure that **Probe** is in HOME position.	(1) 16.3.1
HOME ARM		Activate command HOME od aspiration ARM If it is in HOME, it will repeat the operation.	Before running this test make sure that both the **Probe** and the **Sample tray** are in HOME position.	(1) 16.3.1
HOME DILUTER		Activate command HOME the Syringe piston. If it is in HOME, it will repeat the operation.		(1) 16.3.1
MOVE Z	**See Warnings**	Activate the command to move the Probe as shown on the table on the right, starting from HOME position. Before running this test: Position Probe and Plate ro HOME Insert the parameter into the space: mm/10 (decimal of millimeters), see Warnings.	**DO NOT exceed the Maximum range** Sample = max 350 Reagent = max 800 cuvette = max 590 wash = max 400 Primari tube = max 800 Pre-dilution = max 700 module **ISE** = max 250 clean-cal.**B** = max 180	(2) (2) 16.3.1
TEST Z	**See Warnings**	The test activates a proram of a random movement of the PROBE. Enter the number of cycles into window: “mm/10“ “**SAMPLE TEST REPEATS**“. (I plurali non c’entrano) Before running this test: Position the probe and the sample tray into Home position. Insert the parameter into the space: “mm/10 “, See Warnings.	**DO NO exceed the Maximum range** Samples = max 350 Reagents = max 800 cuvette = max 590 wash = max 400 Primari tube = max 800 Pre-dilution = max 700 module ISE = max 250 clean-cal.B = max 180	(1) 16.3.1
MOVE PLATE	SAMP 1	The test moves the Sample **plate** into the selected position. Before running this test – enter the parameter into window: “Position “, see parameters.	Before running this test place Probe into postion HOME	(1) 16.3.1

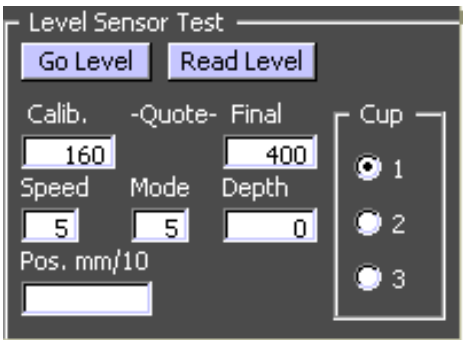
TEST PLATE		The test activates a program of a random movement of the Sample **plate**. Enter the number of cycles into window: “mm/10“. “**SAMPLE TEST REPEATS**“. Before running this Test: Position Probe and plate into HOME position.	Position **Probe** and **plate** into HOME position	(1) 16.3.1
MOVE ARM	WASH SAMP # CUV #	This test activates the Sapling Arm rotation, from its HOME to the programmed position.	Position Probe and plate into HOME position	(1) 16.3.1
TEST ARM		The test activates the random rotation of the Sampling Arm, starting from HOME to the programmed position. The number of cycles are programmed in: **SAMPLE TEST REPEATS**	Position Probe and plate into HOME position	(1) 16.3.1
MOVE DILUTER	3000	This test moves the syringe piston. To run this test enter the volume into window: “µL / 10 “.	Max. volume to be to be programmed is 6000 µL/10	(3) 16.3.1
TEST DILUTER	3000	This test activates a program of a radmom movement of the syringe piston for the volume set in window: “µl / 10“ and the number of cycles as set in: “**SAMPLE TEST REPEATS**“.	Max. volume to be to be programmed is 6000 µL/10	(3) 16.3.1
AIR PUMP		To command the AIR PUMP, it is necessay to activate PWR ON and AIR [|] in both Sampling and Cuvette Systems. To activate pump – click [|] To stop pump – click [O]	At the end click [O] in Sampling system	
P1 PUMP	2000	Before staring this test, program, program the volumr into window: “ µ l “ (example 2000 µ l). Click on [P2] to activate pump and dispense the programmed volume of (2000 µl).	Before running this test, position: HOME MOVE Arm to wash Activate pump P7 to empty waste receptacle.	
P4 PUMP		To activate pump – click [|] To stop pump – click [O]	During the execution of this test activate the pump P7 to empty the waste receptacle.	
MIXER		Click on [MIXER] to activate the mixing. (max. time is 3 sec)		

17.3.4.1 Liquid Level Sensor for Samples

1. Dispense 600 µl of dist. Water into a sample cup.
2. Position the cup into position 1, on the sample plate.
3. Execute a **[HOME Z]**, **[HOME piatto]** and **[HOME Arm]**.
4. Click on "**Position**" and select "**Sample 1**"
5. Click on **[MOVE ARM]** to position itself on Sample 1.
6. Click **[Level sensor]** below on left of the figure.
7. Click on **[Go Level]** the Probe dips into the sample cup until it touches the liquid.



8. In the window "Pos.mm/10" is displayed a value in mm/10, which indicates the number of steps done by the Probe to detect the liquid. See Figure below.
9. Repeat the test to assure its reproducibility.
10. Check that the value is about 290 ± 30
11. Click on the grey area to end the testing of the level sensor.
12. At the end of the test, click on **[HOME Z]**, **[HOME Plate]** and **[HOME Arm]** to position all moving parts into HOME.



17.3.4.2 Sample Bar Code Reader (optional)

! The reader is active for the following codes:

F) UPC/EAN
G) Code 39
H) Interleaved 2 / 5
I) Codabar
J) **Code 128 is reserved to identify the sample Rack.**

Follow step by step the following test:

1. Position a primary tube with a Bar Code lavbel into position 38 inside the Sample plate.
2. Click on "**Bar-code**" to open the test window. See figure on the side.
3. Click on **[HOME Z]** and **[HOME Plate]**
4. Click **[INIT]** and make sure you hear three beeps.
5. Clic **[SCAN]** verify that the Bar Code identification number displayed is the same as that printed on the test-tube lable.
6. In case of no reading or a false reading,
7. the display will indicare " NR " (NO reading)
8. Click on the grey area to end the test on the Bar Code reafer.

! The BAR_CODE reader uses a laser system, avoid to look directly onto the laser beam

17.4 PrintMeth.Exe

Program to save the personal data such as Methods, Standards, Controls, Profiles and the Qualità Control data onto a floppy disdette or onto the hard disk of the analyzer.
If necessary, the saved data can be printed.

Start Procedure

1. Turn On the analyzer and wait for the boot procedure, when the first image of Windows is displayed, press "**CTRL**" until the desktop of Windows is displayed.
2. Insert the "**HUMASTAR TOOLS**" diskette into drive A and follow instructions:

- Double click on the icon "floppy A"
- From the open window select **PrintMeth.exe**

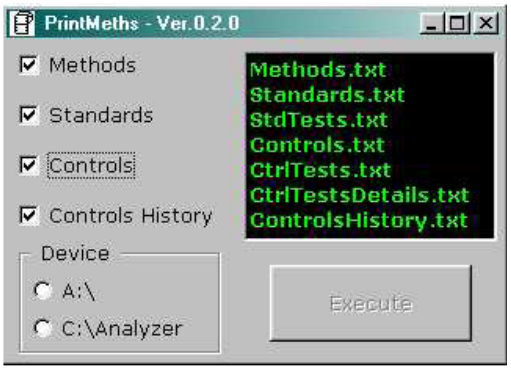
Double click on "**PrintMeth.exe**" and wait until the program is loaded. After a few seconds the image below will be displayyed.

Select the data to be saved and where to:

- **A : **
- **C :\ Analyzer**

Press "**Execute**" to save the data. After each saved file a confirmation will be requested. When all the data is being saved, the following files are going to be memorized.:

- Controls.txt
- Methods.txt
- Standards.txt
- StdTest.txt
- CtrlHistory.txt
- CtrlTest.txt
- CtrlTestDetails.txt



The memorized file format is TXT, and some of the foles are displayed as follows:

File controls.txt

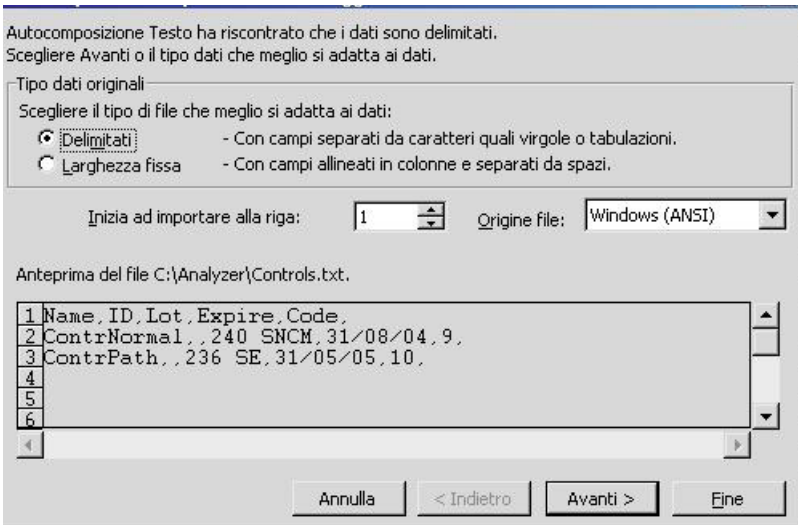
Name,ID,Lot,Expire,Code,
ContrNormal,,240 SNCM,31/08/04,9,
ContrPath,,236 SE,31/05/05,10,

File standards.txt

Name,Lot,Expire,Code,Master,Point,ISE,
[ISE Cal. B],112233,08/10/05,70,Falso,0,Vero,
Alb,01,,150,Falso,0,Falso,

Calcium,def,08/09/10,63,Falso,,Falso,
CalNormal,ghi,31/12/10,43,Falso,,Falso,
Chol,02,,151,Falso,0,Falso,

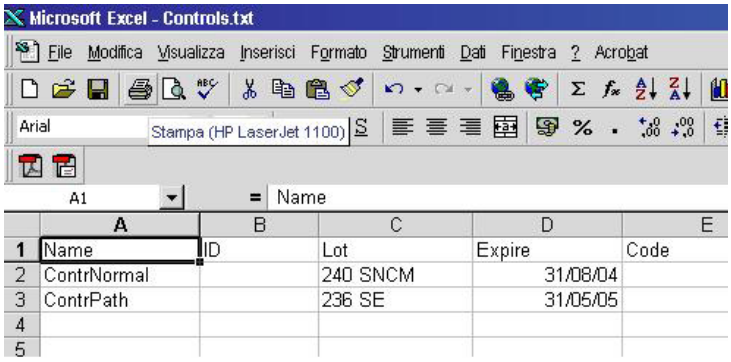
To print these files in a more legible form, open the files in EXCEL, and insert the following parameters:
a) Select the type of file that is best for the data.:
Select: **DELIMIT**


Autocomposizione Testo ha riscontrato che i dati sono delimitati.
Scegliere Avanti o il tipo dati che meglio si adatta ai dati.
Tipo dati originali
Scegliere il tipo di file che meglio si adatta ai dati:
Delimitati - Con campi separati da caratteri quali virgole o tabulazioni.
Larghezza fissa - Con campi allineati in colonne e separati da spazi.
Inizia ad importare alla riga: 1
Origine file: Windows (ANSI)
Anteprima del file C:\Analyzer\Controls.txt.
1 Name,ID,Lot,Expire,Code,
2 ContrNormal,,240 SNCM,31/08/04,9,
3 ContrPath,,236 SE,31/05/05,10,
4
5
6
Annulla
< Indietro
Avanti >
Fine

b) Select the COMMA type that is better for some of the data.
Select: **COMMA**

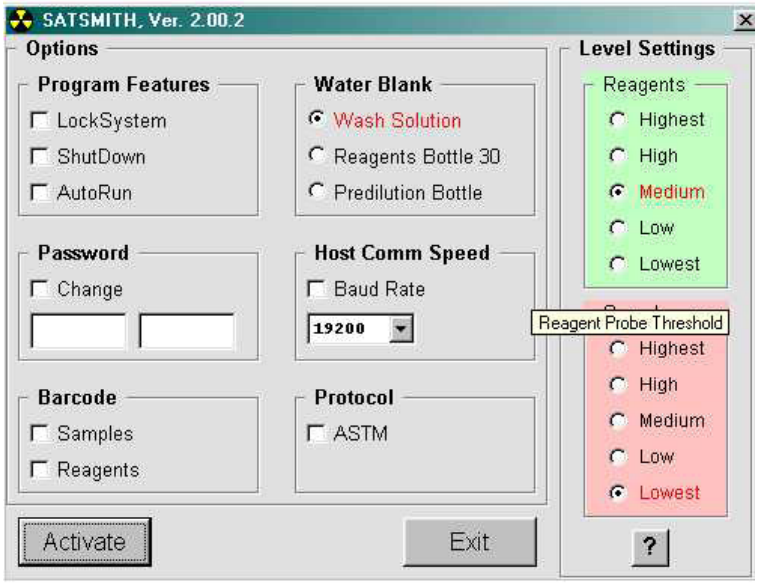
Press END to end operation and to open the file EXCEL.
(see image below)

Adapt the columns and the lines to fit the whole data comfortably, then activate print.



17.5 SatSmith.exe

This program enables to activate and de-activate some special functions of the analyzer and to modify some specific parameters.
Doubleclick on “SatSmith.exe” and wait until the program is loaded, and the image on the right is displayed.
The colored options are those presently in use. The display shows eight fuctional areas:



Program Features

- LockSystem: Disables the specific keys on a Windows keyboard, including the combination of more keys.
- ShutDown: Enables the automatic switching OFF of the analyzer at the end of a working cycle.
- AutoRun: Enables the automatic START of Clinical Chemistry program.

Password

- Password: Enables to change the password to access expert mode.

Barcode

- Barcode: Activates – de-activates the Bar Code Reader.

Host Comm Speed

- Host Comm: Enables to adapt the baud rate transmition between the analyzer and the external computer, selectable from a menu.

Protocol

- Protocol: Activates the transmition ASTM protocol.

Level Settings

- Level Settings: To vary the sensitivity of the liquid level sensor of the Probe. Maximum sensitivity is “LOWEST”,and minimum is “HIGHEST“ (do NOT change).

- **Activate:** To Save the modificarions:

17.6 SaveDbChem.exe

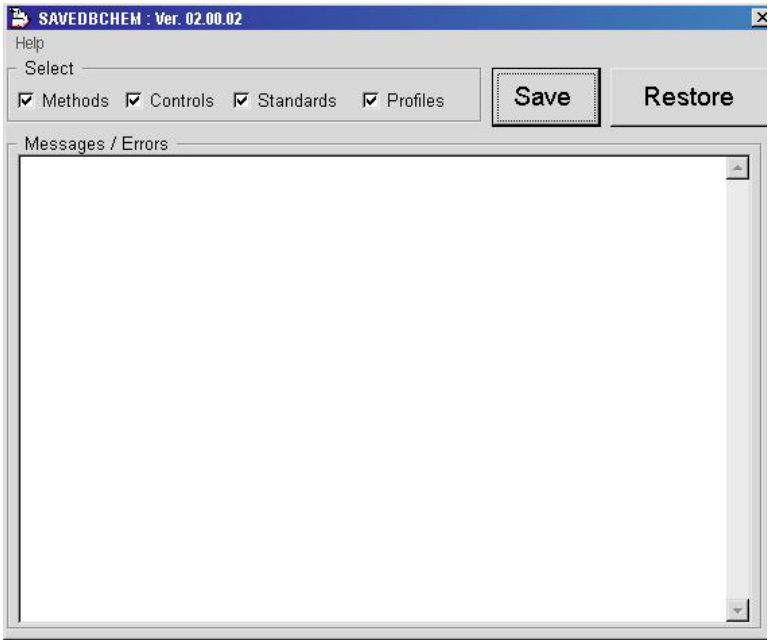
With this program enables to activate the program to save the the personal such as Methods, Standards, Controls and Profiles that are memorized on the analyzer into a temporary Data Base (file in MDB format), onto a floppy diskette. This file can be used to update the Data Base on all analyzers using the same revision.

Click on “**SaveDbChem.exe**” and wait until the program is loaded and the below image is displayed:
The graphic image on the right enables to “**SELECT**“ the four options:

- **Methods**

- **Controls**
- **Standards**
- **Profiles**

Select one or more options and press "**SAVE**"
To update the permanent Data Base, press "**RESTORE**"
Before saving (save) insert the floppy diskette and make sure its not protected.
In any case it will generate a Message-errors in RED with the No. 3051.



17.7 Communication Protocol

17.7.1 DATA EXCHANGE WITH HOST COMPUTER

The **HUMASTAR 300** software enable to exchange data with other computers, via a serial port RS – 232 or from a floppy disk.
There are two instructions:

1. Transfer a WORKLIST from Host to the Analyzer (Download).
2. Transfer RESULTS to the Host (Upload).

17.7.2 HOST COMPUTER SETUP

HUMASTAR 300 has a built-in serial line RS232 (COM 1) that enables to preset the communication speed via its software. Such modification takes place by programming the serial port via the computer board. For further information see section 16 paragraph 16.5.

The Host computer that is connected to the **HUMASTAR 300**, has to have its transmition parameters preset. (default values) as follows:

19200, N, 8, 1, XON/XOFF

17.7.3 CONNECTIONS

The HOST computer has to be connected to the serial port 1 of the **HUMASTAR 300** (COM 1), by a serial cable with the following connections:

HOST COMPUTER (DTE) **HUMASTAR** 300 (DTE)

DB9	DB25		DB9
2	3	----------	3
3	2	----------	2
5	7	----------	5

17.7.4 PROTOCOL STRUCTURE

The data exchange is organized in packets. These can be classified as:

Prologue Packet: sends first a file indicating the number of lines that will be transferred. Followed by the structure of that data packet:
HeadChar + " " + NumberOfLines + " " + CheckSum + CR

Data Packet: sent after with the following structure:
HeadChar + " " + DataRecord + " " + CheckSum + CR
" " this character is a space with the value of (ASCII 32 - HEX 20)

- **HeadChar:** is a sinle character at the start of a line, such as:

"R" (Risults) in case of transmition
"P" (Patient) in case of reception

- **NumberOfLines:** is the number of lines that are to be transferred, its format is 5 digits with leading spaces.

- **DataRecord:** is described in the paragraph ”Transmition and Reception” Each field of DataRecord has to be different from the others with a separating character “ | ” (ASCII 124 - HEX 7C).

- **CheckSum:** is calculated by adding the ASCII value of each packet of characters from HeadChar up to „ „ (but without including it) before the CheckSum. This corresponds to four digits in hexadecimal format without spacing with leading zeroes (example 0EA2). Below is given an example of CheckSum reception of a specific introductory WORKLIST:

P 2 0122

Char	ASCII Dec	ASCII Hex
`P`	80	50
` `	32	20
` `	32	20
` `	32	20
` `	32	20
` `	32	20
`2`	50	32
	290	122

CR stands for Carriage Return (ASCII 13 - HEX 0D)
Each transmition should start with a data packet, where the first informarion after the letter “P” or “R”, indicates the number of lines that will follow:

Structure example:
Prologue HeadChar + “ “ + “ 2 ” + “ “ + CheckSum + CR
Data HeadChar + “ “ + DataRecord + “ “ + CheckSum + CR
Data HeadChar + “ “ + DataRecord + “ “ + CheckSum + CR

Practical example:
P 2 0122(sent a worklist, with two patients and a checksum of 0122)

17.7.5 TRANSFER OF A WORKLIST (RECEPTION FROM HOST)

HeadChar is „P“ and the DataRecord are structured accroding the following Table:

Parameter	Dimension Max	Accepted Values
ID Patient (1)	13 characters	Empty / Alphanumeric
Last Name (2)	16 characters	Empty / Alphanumeric
First name	12 characters	Empty / Alphanumeric
Age	2 digit	Empty / Number
Sex	1 digit	0 = Female 1 = Male
Time entered	4 carat.	Format “HHMM”
Comments	22 carat.	Empty / Alphanumeric
Type of sample	1 digit	0 = Serum / Plasma 1 = Urine 2 = FCS
List of Tests (3)	Variable Length	Alphanumeric (4)

(1) Can be empty only if “ Last name” is not empty
(2) Can be empty only if “ID Patient” is not empty
(3) DataRecord must have the list of tests for the patient.
(4) Each test must within the string „°“ (ASCII 176) and „§“ (ASCII 167) and must be max 6 characters

Example

P 27 0139
P # 1|Rossi|Mario|48|1||Ematologia|0|°AST§°BilBic§°CREAT§°GLUC§ 189E
P 38489|||18|1|||2|°ALT§°AST§°CREAT§°IRON§ 0FF8
P # 3|Bianchi|Antonella|14|0|||0|°ALT§°AST§°CHOL§°GGT§°TRG§ 1748
P # 4|||18|0|||0|°AST§°BilBic§°CREAT§°GLUC§ 1093
P 38490|||18|0|||0|°Cl§°K§°Na§°ALB§°ALB/GL§°BUN§°T.P.§ 1798
P # 6|||18|0|||0|°AST§°BilBic§°CREAT§°GLUC§ 1095
P # 7|||18|0|||0|°AST§°BilBic§°CREAT§°GLUC§ 1096
P # 11|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11C5
P # 12|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11C6
P # 13|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11C7
P # 14|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11C8
P # 15|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11C9
P # 16|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11CA
P # 17|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11CB
P # 18|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11CC
P # 19|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11CD
P # 20|||18|0|||0|°ALT§°BilFix§°BilVAr§°GLU2R§ 11C5
P # 21|||18|0|||0|°GLUPRE§ 08E5
P # 22|||18|0|||0|°GLUPRE§ 08E6

P # 23|||18|0|||0|°GLUPRE§ 08E7
P # 24|||18|0|||0|°GLUPRE§ 08E8
P # 25|||18|0|||0|°GLUPRE§ 08E9
P # 26|||18|0|||0|°GLUPRE§ 08EA
P # 27|||18|0|||0|°GLUPRE§ 08EB
P # 28|||18|0|||0|°GLUPRE§ 08EC
P # 29|||18|0|||0|°GLUPRE§ 08ED

Where:
P # 1|Rossi|Mario|48|1||Ematologia|0|°AST§°BilBic§°CREAT§°GLUC§ 189E

P + spazio:	start of DataRecord (space = ASCII 32 - HEX20)
# 1:	identification of sample (max 13 characters)
Rossi :	First name (max 16 characters)
Mario :	Second Name (max 12 characters)
48 :	Age
1 :	Sex (0 = Female 1 = Male)
Empty field :	Time entered
Hematology :	Comments (max 22 characters)
0 :	Type of sample (see table)
° :	start Test name (° = ASCII 176)
AST :	Test name (max 6 characters)
§ :	End Test name (§ = ASCII 167)
189E :	Checksum hexadecimal
CR :	Carriage Return (ASCII 13 - HEX 0D)

Each Test has to have always an initial and an end character.

Each area has to be separated by the symbol "|" (ASCII 124 - HEX 7C)

17.7.6 TRANSFERRING RESULTS TO HOST COMPUTER

HeadChar is „R" and the DataRecord is structered according the following table.

Parameters	Succepted Values - Length
ID Patient (1)	Empty / Alphanumeric – 13 characters
Last Name (2)	Empty / Alphanumeric – 16 characters
First Name	Empty / Alphanumeric – 12 characters
Age	Empty / Alphanumeric – 2 digits
Sex	0 = Female – 1 digit 1 = Male
Entry time	"HHMM" format – 4

Comments	Empty / Alphanumeric – 22 carat.
Type of Sample	0 = Serum/Plasma 1-digit 1 = Urine 2 = CSF
Test Name	Alphanumeric - 6 carat.
Type of Result	-1 = To repeat – 2 digits 0 = OK 1 = Result lower then Normal Range 2 = Result higher the Normal Range 3 = Optical Density out of Range 4 = Reagent Blank out of Range 5 = Substrate Depletion 6 = Kinetic measurement non linear 7 = Standard not available 8 = Error in test Log / Logit 9 = Negative Result 10 = Result outside of Linearity Range 11 = Missing reagent 12 = Missing sample 13 = Error in ISE module
Result	Use period as separator.
Measurement Units	Alphanumeric
Min Normal result	
Max Normal result	
Date of Test	Format Data “YYYYMMDDHHMM

(1) Can be empty only if there is a Last Name, however, if the data is to be memorized in the „Pending List“ – it has to have a valid ID code.

(2) Can be empty only if there is a valid “ID Patient.”.

Example:

R # 1|Rossi|Mario|48|1||Ematologia|0|BUN|0|10.2|mg/dl|15|50|200406201030
189E

where:

R + space:	is the start of DataRecord (space = ASCII 32 . HEX 20)
# 1 :	Identified Patient (max 13 characters)
Rossi :	Last Name (max 16 characters)
Mario :	First Name (max 12 characters)
48 :	Age
1 :	Sex (0 = Female 1 = Male)
Empty field :	Time entered
Hematology :	Comments (max 22 characters)
0 :	Type of Sample (see table)

BUN :	Test name (max 6 characters)
0 :	Type of Result (see table)
10.2 :	Rresult (use period for the decimal point)
mg/dl :	Measurement Units
15 :	Min. Normal Value
50 :	Max Normal Value
200406201030 :	Format date year – month – day – hour - minutes
189E :	Checksum hexadecimal
CR :	Carriage Return (ASCII 13 - HEX 0D)

Each field has to be separated by the symbol " | " (ASCII 124 - HEX 7C)

18 MAINTENANCE

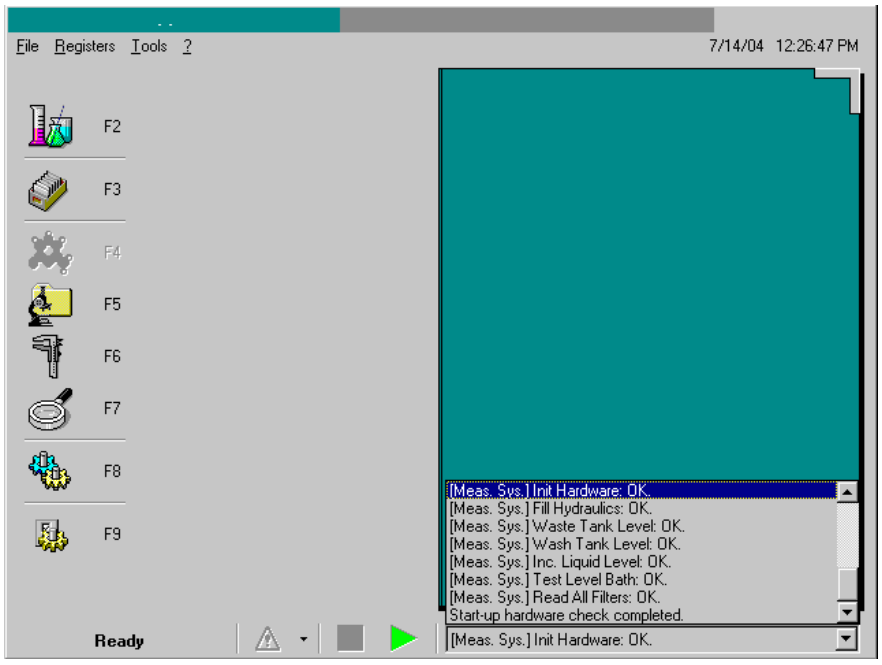
18.1 Preface

This paragraph describes the step by step operations that the analyzer does when turned ON and during its normal operating cycle.

18.2 Operating Program Checks

The Maintenance Program (F8) is part of the operating program, divided into three parts:

1. **Reagent System**
2. **Sample System**
3. **Measurement System**



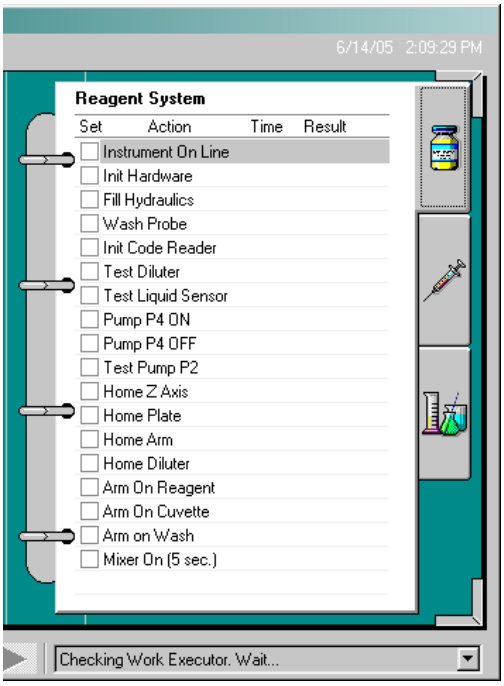
As the analyzer is turned ON, the operative program is loaded, initializing the Hardware and performs a number of checks and controls to assure a perfect operation of the analyzer. The operator can check each operation done in the Maintenance Program.
The checks made are also shown in on the right below. When all controls have been successfully done, the green **START ▶** **triangle** will be lit. to indicate that

the analyzer is ready to operate, otherwise a **red** ⚠ **triangle** will go ON, indicating a malfunction.
Click on the arrow next to the triangle, a window will open to indicate the system with the malfunction. In the Maintenance Program (F8), the malfunction will be indicated in red **WARNING** in the column "Result". Once the malfunction has been eliminated, the analyzer remains in a Standby position and ready to be programmed for the daily workload.
To monitor the correct operation between the user interface and the modules, a check is made every 3 min. and visualized as follows:
HH.MM.SS Auto - check OK.
To access the control menu, go to the Maintenance Program (F8).
To make a check, click on its **CHECK BOX** ☑and then clock **START** ▶
Before performing the requested check, an additional consensus will be requested.
It is possible to request several checks at the same time, they will be performed in the sequence they have been ordered by the CHECK BOX ☑.

18.2.1 REAGENT SYSTEM

! At the end of testing – disactivate Pump P7 - [Pump P7 OFF]

During Analyzer initialization, the first four checks are automatically performed. The remaining checks can be requested by the operator or when necessary in case of a malfunction in the Reagent System with a WARNING ⚠

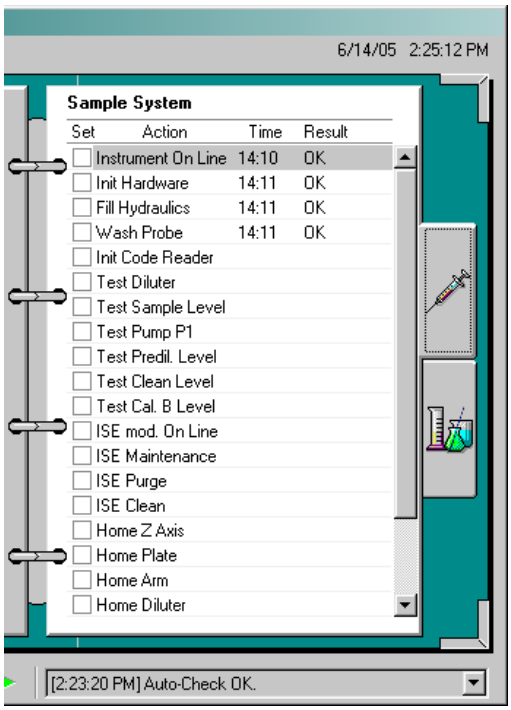


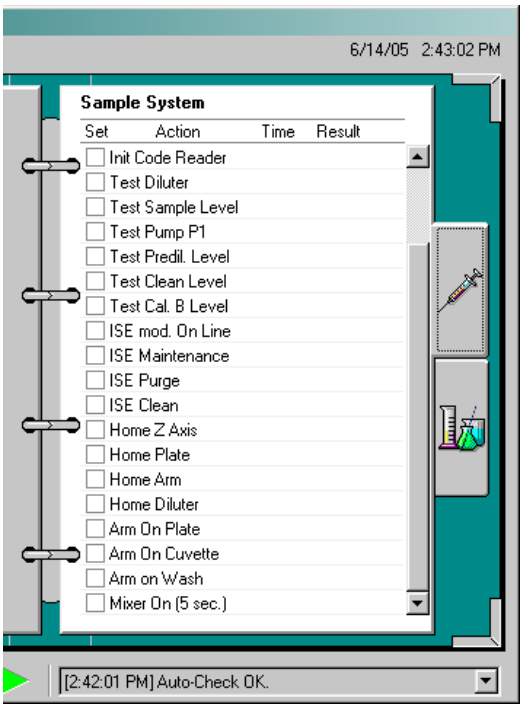
To perform checks:
All checks can be easily performed without a problem, however, **special attention is needed when checking and/or activating the Peristaltic Pumps**.
In order not to create malfunctions when activating the pumps, proceed as follows:

- Position the Reagent Arm **above the WASHING WELL (WASH)**, if necessary activate command [Arm on Wash].
- To expel the wash solution, activate pump **P7** in the Cuvette Measurement System **[Pump P7 ON]**.

1. **[Test Pump P2]: Pump** P2 will operate for about 2 seconds. The pump will expel via the Probe the quantity of liquid it aspirated from the WASHING well.
2. **[Pump P4 ON-OFF]**: it will start or stop the Pump **P4**. The pump transferrs Wash Solution from the Wash Container into the Washing Well.

18.2.2 SAMPLING SYSTEM





During Analyzer initialization, the first four checks are automatically performed. The remaining checks can be requested by the operator or when necessary in case of a malfunction in the Sampling System with a WARNING ⚠.

To perform checks:
All checks can be easily performed without a problem, however, special attention is needed **when checking and/or activating the Peristaltic Pumps**.
In order not to create malfunctions when activating the pumps, proceed as follows:.

- Position the Sampling Arm **above the WASHING WELL (WASH)**, if necessary activate command **[Arm on Wash]**.
- To expel the wash solution, activate pump **P7** in the Cuvette Measurement System [Pump P7 ON].

1. [Test Pump P1]: Pump P1 will operate for about 2 seconds. The pump will expel via the Probe the quantity of liquid it aspirated from the WASHING well.

! At the end of testing – disactivate Pump P7 - [Pump P7 OFF]

To Check the ISE Module (optional)
In this section there are some controls to clean the electrodes, as follows:

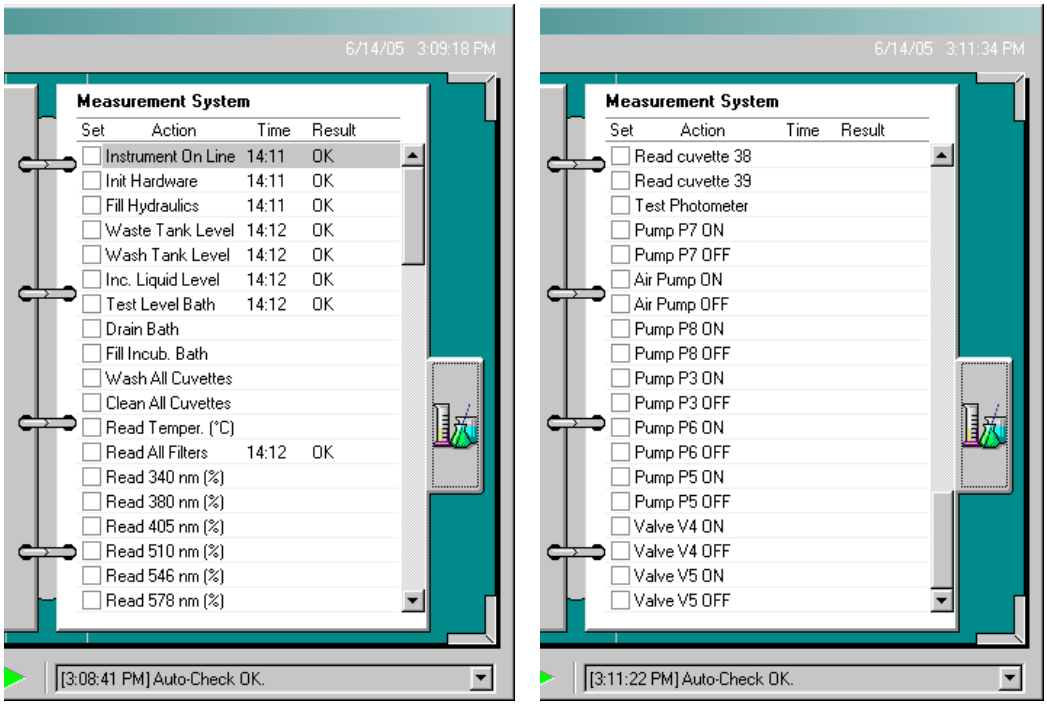
1. **[ISE mod. On LIne]**: checks the communication between the PC Master and the ISE Module.
2. **[ISE Maintenance] - [ISE PURGE]**: the electrodes are washed with Calibrator A.
3. **[ISE CLEAN]**: the electrodes are cleaned with the “Clean” solution present on the Sample Tray.

This operation has to be done every time there are problems in Calibrating the ISE Module. If problems persist in Calibration, see „21 Optional Modules“, detailed description of the **ISE** module.

18.2.3 REACTION AND MEASUREMENT SYSTEM CHECKS

During Analyzer initialization, the first seven checks are automatically performed, including **[Read all Filters]**. The remaining checks can be requested by the operator or when necessary in case of a malfunction in the System with a **WARNING** ⚠.

To perform checks:
All checks can be easily performed without a problem, however, **special attention is needed when checking and/or activating some of the parts**.



In order not to create malfunctions, proceed as follows:

1. **[Valve V4 ON-OFF]**: Make sure that pump **P6** is working, if necessary activate **[Pump P6 ON]**.
2. **[Pump P5 ON-OFF]:** turns ON and OFF the pump. It expels Wash Solution aspirated from the Wash Solution Container.
3. **[Pump P6 ON-OFF]:** turns ON and OFF the pump that supplies the bi-distilled water for the incubation bath. If necessary activate **[Fill Incub. Bath]**. **Do not activate this pump without water for more then 5 min, it may ruin the pump.**

! When finished testing make sure that Pump P6 is ON and the container with bi-distilled water is full.

18.3 Deviced for maintenance

Table 13 displays the devices that are available upon request and are necessary for checking and mechanical alignment of the Analyzer.

FIGURE 49

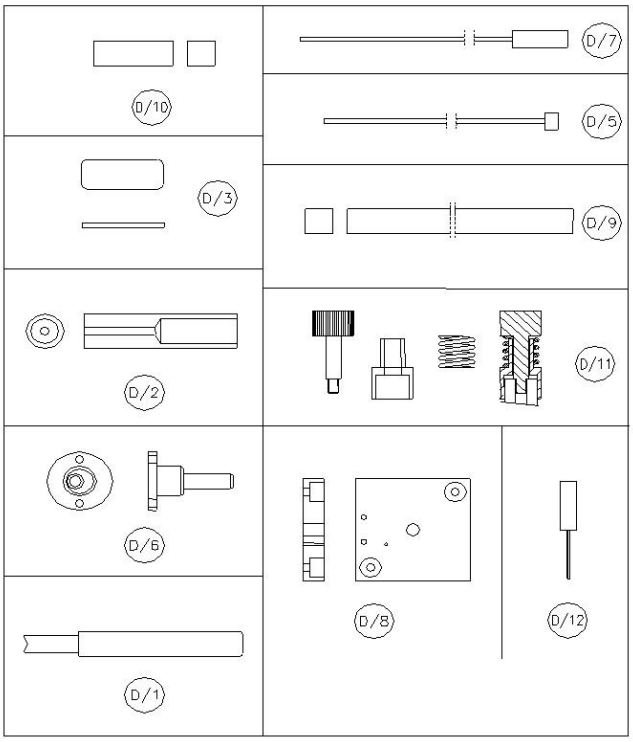


TABLE 15

CODE	REFER. NUMBER.	DESCRIPTION
MS1126.01	D/1	Cuvette Extractor
MS1127.01	D/2	Device to center the cuvette washing Probe
MS1129.01	D/3	Device for homing The Sampling Probe
MS1131.01	D/5	Probe to align the Sampling Arm
MS1132.01	D/6	Pin to align the cuvette plate
MC0161.01	D/7	Device to clean the Probe internally
MS1133.01	D/8	Device to align the Encoder
MS1135.01	D/9	Device to adjust the height of the cuvette Washing Arm
MS1130.01	D/10	Device for homing the Diluter
MC0162.01	D/11	Friction device to block the cuvette plate
MC0169.01	D/12	Pin to align the encoder
MS0314.01	D/28	Device to Insert and/or Extract Interference Filters. (design not shown)

18.3.1 TO REMOVE CASING

The Analyzer casing has three removable panels, that can be removed if necessary.
The following procedures refer to „Figure 42“ and „Figure 43“.

! All the procedures described below may seem complicated, however, the authorized service engineers will know which panel (or all panels) to remove, when performing maintenance on the Analyzer.

18.3.1.1 Top Cover (4)

1. Remove screws (1) and washers (2) that hold the top cover to the lower part of the Analyzer.
2. Remove the locking knobs (4) that block the top panel from the top cover.
3. Remove the nuts (3) using a 7mm hexa-key, and remove the top cover including the Plexiglas.

! DO NOT touch the plexiglas when removing the top cover, it maybe easily ruined.

18.3.1.2 Top Panel (11)

1. Remove the plastic covers from the Reagent, Sample and the Cuvette Plates.
2. If present, remove the cover of the cuvette Washing Probes, by removing the blocking knobs (4).
3. Remove the cuvette washing Arm (see „18.7.2.4 Replace the Washing Arm Motor“.).
4. Remove the Sample Tray.
5. Remove the blocking knobs (4) from the top panel.
6. Place in the center opening both the Reagent and Sampling Arms.
7. Remove the top panel (5).

18.3.1.3 Back Panel (1)

1. Remove all the electrical connectors from the power supply.
2. Remove screws (11) and washers (12) to remove the back panel (13).

18.3.1.4 To Replace the Plexiglas Panel

1. Remove screws (15) that hold the Plexiglas panel to the hinge, and remove it.
2. Remove screws (8) and washers (9).
3. Remove the supports (6) and (7) from the panel.
4. Insert the new panel and assemble in reverse as described above.

FIGURE 50

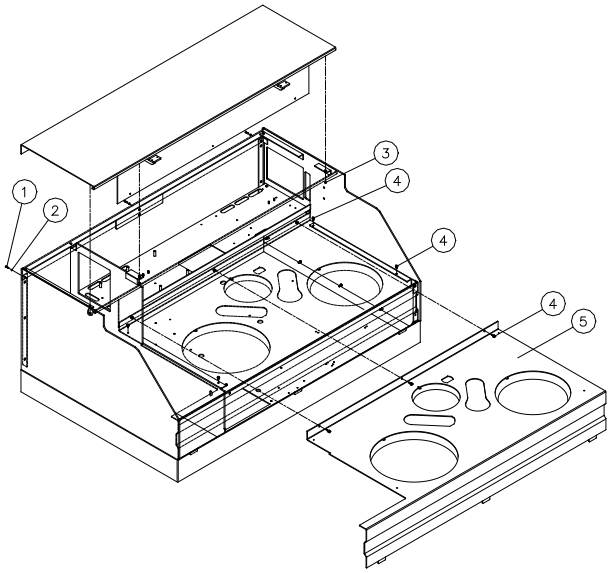
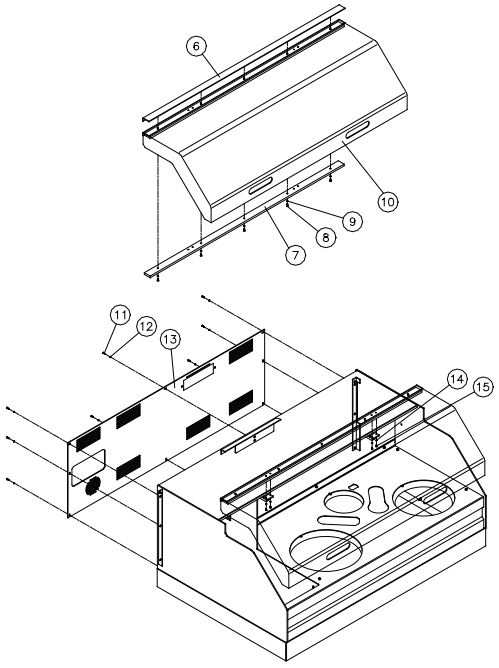


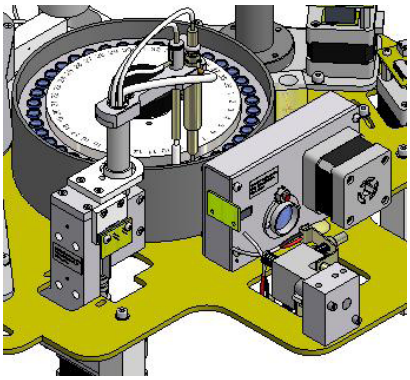
FIGURE 51



18.4 Photometer Module

18.4.1 PHOTOMETER

Reaction and Measurement System, Incubation chamber, Cuvette plate, Washing System, Photometer module with lamp.



18.4.1.1 To Replace Photometer Lamp

1. Remove the side panel
2. Disconnect the photometer lamp from its power supply board.
3. Remove the lamp holding knob.
4. Remove the knob of horizontal Adjustment.
5. Replace the lamp.
6. **DO NOT TOUCH THE LAMP WITH YOUR FINGERS. Use the plastic cover to insert the lamp.**
7. Proceed in reverse to lock the lamp.

! (Operation to be done with analyzer turned OFF – see Fig.„Figure 44“)

! If all the values are lower then 60% or higher then 90%, it is possible to adjust the sensitivity of the amplifier using the PR1 of the ADC P/N EB0089.01 board. See Chapter 9. If one or more filters are less then 60% or more then 90%, it will be necessary to equalize those interference filters. (see „18.4.2 To Equalize and Replace Filters“).

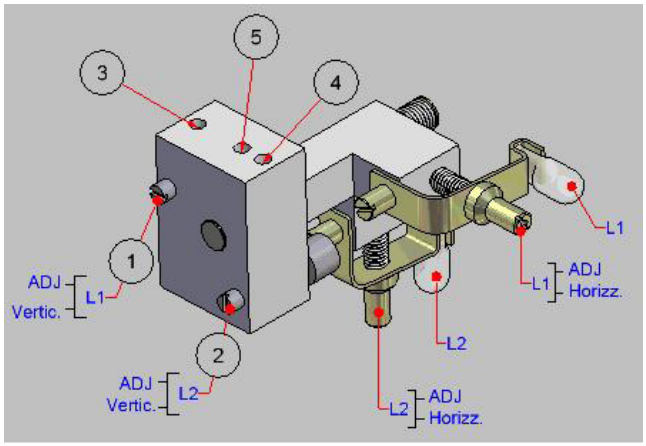


FIGURE 52

Procedure 1: alignment of lamp using Analyzer Maintenance (F8)

8. Turn On the Analyzer.
9. Pipette into cuvette **38** - 500 µl of dist. water.
10. Go to **Maintenance (F8) – Reaction Measurement System**.
11. Execute command **[Plate Home]**.
12. Select **[Test Fotometer]** and press START ⚠.
13. The photometer will read continuously at 340 nm for about 80 sec. On the line right of the "Test Fotometer" will be displayed the % Transmission. Use the ADJ Horizz. Knob to obtain the maximum value, loosening screws (3 or 4) and rotate the ADJ Vertic. Knob (1 o 2) to maximize the value. Lock the lamp with its blocking screw. If necessary repeat the alignment to obtain an optimum value of 60% to 90%.
14. Repeat this test for each of the 8 filters, making sure that the value obtained is above the 60% and less then 90%.
15. Insert the second lamp – wait at least 1 min to stabilize the lamp.
16. Repeat the operations as above starting with point 12 to align the second lamp.
17. To align the signal of the two lamps, select the lamp with the higher signal and reduce it accordingly using the **ADJ Vertic. Knob.**

When finished reinsert the side panel.

Procedure 2: lamp alignment using the Diagnostic Program – Tester exe.

The same alignment operations can be made using the Tester exe. in the Service Disk.

18. Turn ON the Analyzer, as soon as the Window display appears, press the "CTRL" key until the program is loaded.
19. Insert the disk into drive A; click on "**Floppy A**" and proceed with program "**TESTER.EXE**".
20. In section "**Cuvette**" click in succession on **[PWR ON], [HOME Z], [HOME PLATE], [HOME FILTER]**.
21. Click on **[Photometer]** to open window „Figure 45".
22. Pipette into cuvette **38** some 500 µl of dist. Water
23. Click on **[WATER B]** to display the decimal value of transmission under the Water B column. (the values have to be larger then zero).
24. Click to select **[Filter 1]** and press **[Move Filter]**.
25. Click on **CHECKBOX** ☑ on the right and then on **[Read One]** to activate the continuous reading with filter (340nm).
26. Adjust knob **ADJ Horizz.** to maximize the value indicating in "READINGS".

! If all the values are lower then 39.000 or higher then 60.000, it is possible to adjust the sensitivity of the amplifier using the PR1 of the ADC P/N EB0089.01 board. See Chapter 7. If one or more filters are less then 39.000 or more then 60.000, it will be necessary to equalize those interference filters. (see „18.4.2 To Equalize and Replace Filters").

! „Table 14" displays the conversion values between the different measurements.

27. Loosen screws (3 or 4) and rotate the ADJ Vertic. (1 or 2) and maximize the value displayed in “READINGS”. Lock the blocking screw. If necessary repeat the alignment to obtain an optimum value that is between 39.000 e 60.000.
28. Click on **CHECKBOX** ☑ to block the continuous reading.
29. Repeat **[WATER B]** and check all the other 7 filters that the values are within the required 39.000 ÷ 60.000.
30. Disconnect the lamp from its power supply board and connect the second lamp for alignment. Wait about 5 min to stabilize the lamp.
31. Repeat operations from 13 above to align the second lamp.

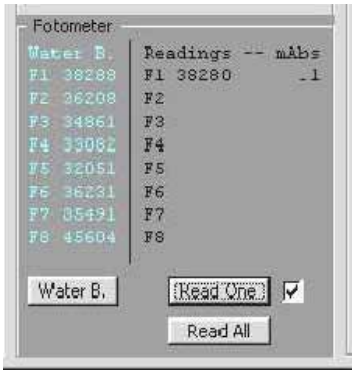


FIGURE 53

When finished, turn OFF the analyzer and reinsert the side panel

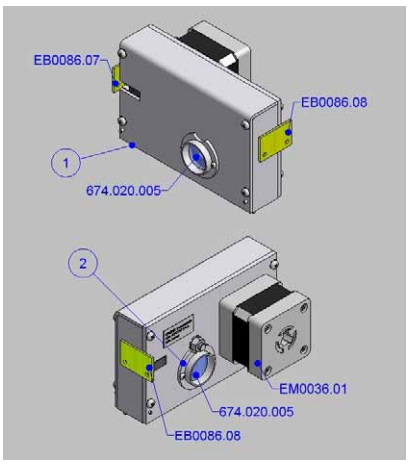
	TP3 mV	Counts A/D	% Trasmission	mAbsorbance x 1000
1	5000	65535	100	0
2	**4580**	**60030**	**91,6**	38,1
3	3810	49937	72,6	118
4	**3000**	**39321**	**60**	221,8
5	2000	26214	40	397,9
6	1000	13107	20	698,9
7	500	6553	10	1000
8	250	3276	5	1301
9	100	1310	2	1,699
10	50	655	1	2000
11	5	65,5	0,1	3000

TABLE 16
Conversion Values

91,6 and **60** are Optimum values for Photometer Lamp alignment.

18.4.2 TO EQUALIZE AND REPLACE FILTERS

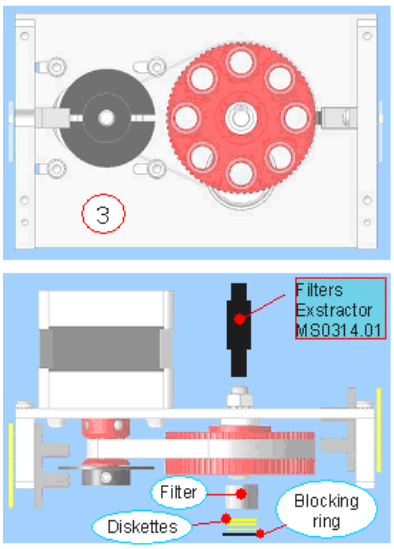
This procedure is to be done using the Tester exe. When maximizing the value at 340 nm and the other filters are below or above the optimum values of 39.000 to 60.000 counts. The Transmission value can be changed by increasing or decreasing of the number of neutral disks present inside the interference filter.



! Before connecting the multimeter, the negative to JP1 of board ADC EB0089.01 and the positive to TP2, check first the voltages of each filter inside the filter wheel. Note the value in Volt of each filter as measured with the multimeter.

FIGURE 54

1. Disactivate the power of the motor, click **[PWR OFF]**.
2. Remove the screws that hold the photometer on its base.
3. Remove the connectors (motor, sensor of Home and Sync).
4. Remove the photometer module.
5. Follow „Figure 46“.
6. Remove the lens holder (2) and panel (1).
7. Insert the filter extractor (MS0314.01) from the motor side and remove one at a time the filters to be equalized. (See table 2). When extracting the filter, watch for the blocking ring and the number of the neutral diskettes it contains.



! The Extractor device MS0314.01 serves both to extract and insert the filters.

! CRONY supplies the neutral diskettes in three blocking sizes, identified as 600, 350 and 100. (the code for the kit is P/N: KO0030.01). Attention - the amount of light blockage of a diskette depends on the wavelength. A diskette “100 “ at 405 nm blocks about 8.500 counts; at 620 or 700nm it blocks only about 3.500 counts. See „Table 15“.

8. If the filter transmission is less then 39.000, take off one or more of the neutral diskettes. If above 60.000 add diskettes accordingly. (see „Table 15“).
9. Once adjusted the filters, reassemble everything.
10. Click in sequence on **[PWR ON] [HOME Z] [HOME PLATE] [HOME FILTER]**.
11. Check transmission of all the filters using the key **[WATER B]**. If the filters are not within its required range, repeat the equalizing procedure again.

TABLE 17
Optimum Values of Transmission

Filter Position	Filter Wavelength -nm	Counts	Volt TP2
Filter 1	340	55000 - 60000	>1 < 1,05
Filter 2	380	50000 - 55000	>0,95 < 1
Filter 3	405	50000 - 55000	>0,95 < 1
Filter 4	510	50000 - 55000	>0,9 < 0,95
Filter 5	546	50000 - 55000	>0,9 < 0,95
Filter 6	578	50000 - 55000	>0,9 < 0,95
Filter 7	620	50000 - 55000	>0,9 < 0,95
Filter 8	700	50000 - 55000	>0,9 < 0,95

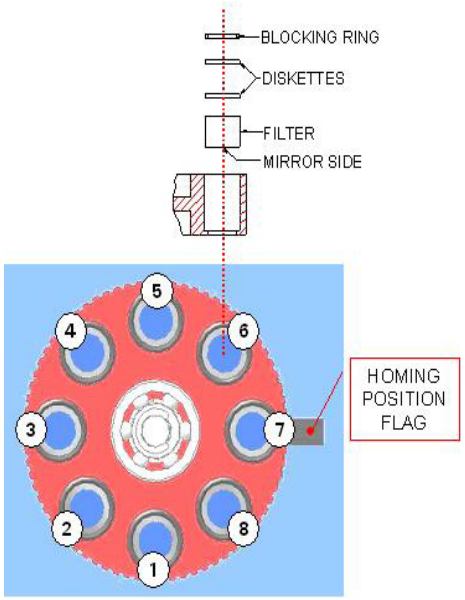
Filter nm	Diskette 600	Diskette 350	Diskette 100
340	--	--	--
380	47500	45800	10000
405	47500	45500	8500
510	35500	30000	4300
546	35500	29000	4300
578	35500	29000	4300
620	35000	285000	3700
700	35000	31000	3500

TABLE 18
Blockage in number of counts for each diskette

! Cuvette 38, has to be filled with about 500 µl of dist. Water. Lamp alignment has to be made with filter 340 nm. No diskettes are used in filter 340 nm.

Standard Filter Configuration

Position	Filter nm
Filter 1	340
Filter 2	380
Filter 3	405
Filter 4	510
Filter 5	546
Filter 6	578
Filter 7	620
Filter 8	700



! Other wavelength filters are available upon request.

18.4.3 REPLACE MOTOR AND BELT.

1. Follow the procedure in „18.4.2 To Equalize and Replace Filters“.
2. Remove the screws that hold the panel (8), „Figure 47“.
3. Loosen the hexa screw (2) and (9) that hold the Sync disk (7) and pulley (10).
4. Remove the screws that hold the motor and take it out.
5. Replace the **motor and/or** the **belt.** Reassemble the pulley and the Sync disk, lock in the screws without tightening them.
6. Adjust the tension on the belt (1), by pulling the motor to have a 2 mm flexibility in the center of the belt with 500 g of pressure (see arrow) and block the screws.
7. Position the filter wheel (3) with the flag Home (4) in the center of the opto (5) and the slit of the Sync disk (7) in the center of the opto (6).(„Figure 48“), tighten the screw of the Sync disk. (use a hexa key 2mm).

FIGURE 55

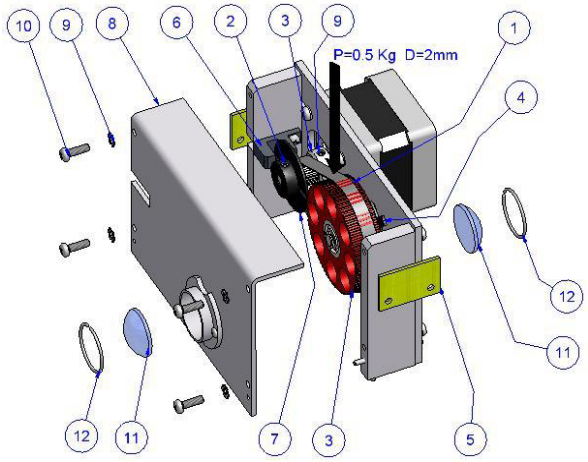
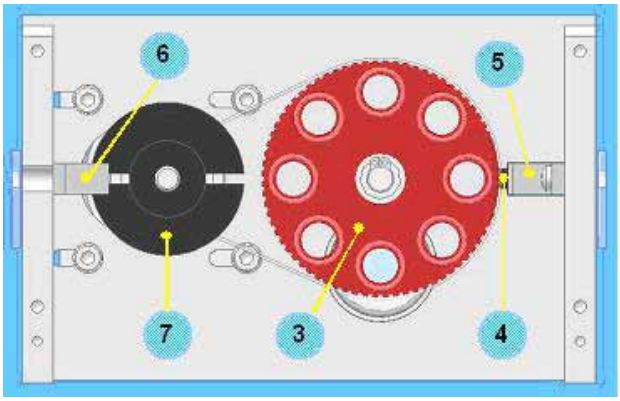


FIGURE 56



18.4.4 REPLACE AND CLEAN LENSES

Use silicon gloves not to dirt the lenses.

1. Remove the O-ring (12) and remove the lenses (11). „Figure 47“.
2. Clean the lenses and remount. Make sure to press the closing O-ring well.

18.5 Temperature Adjustment and Control

To test the temperature in the incubation bath and the Reagent chamber it is necessary to use a thermometer with a micro-thermocouple with a precision of 0.1°C.

18.5.1 CHECK TEMPERATURE IN INCUBATION BATH

The measurement should be made at least 20 min after having turned ON the Analyzer, the incubation bath filled with bi-distilled water.

Temperature Check and Adjustment inside the Cuvette.

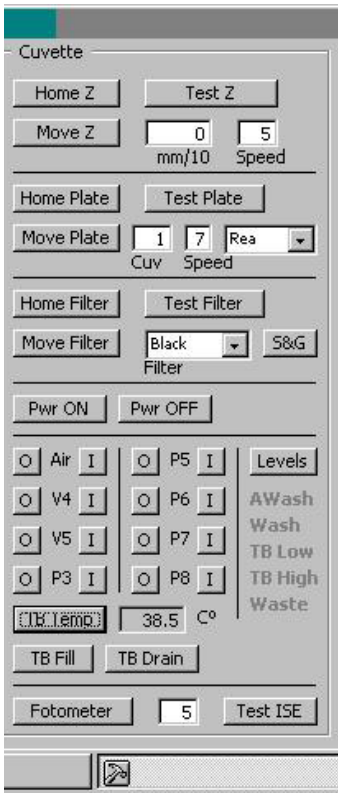
1. In Maintenance Program (F8) select Reaction and Measurement System, activate [Fill Incub. Bath].
2. Dispense 500 µl of dist. Water into cuvette 25 in the cuvette plate.
3. Insert the thermocouple into the cuvette, making sure that it is completely immersed in the water. Let it stabilize for 180 sec.

The temperature should stabilize itself to 37°C ± 0.2 °C.

4. If necessary adjust the temperature on board EB0043.01 as follows:

- Connect the negative pole to the multi-meter onto TP1 and the positive one onto TP5.
- Measure the voltage, about +3,08 VDC
- To increase or decrease the voltage use R26.
- Each 10mV corresponds to about 1°C.

5. Finished adjustment – check temperature on the monitor.
6. Select **[Read. Temp.(°C)] „Figure 49“**.



7. The temperature displayed on the Monitor, although precise, may vary on the Monitor ± 1°C due to its low resolution, in any case the value should be between 36 and 43°C.
8. Should the temperature be out of range there will be a flag with a **WARNING**.
9. To align the real value of the temperature with that displayed on the Monitor, see section below.

To Aligh the measured Temperature with that displayed on the Monitor.

To aligh the two temperatures, one has to adjust the reference voltage on the A/D converter of the CPU slave board. Proceed as follows:

1. Exit program and turn OFF the Analyzer.
2. **Remove the CPU slave board of the Cuvette Measuring System.**
3. Turn On the Analyzer and load the Diagnostic Tool Program Tester.exe.
4. Click in sequence only in that section **[PWR-ON], [HOME Z], [HOME PLATE], [HOME FILTER]** (see „Figure 49“).
5. Activate pump 6 **[I]** and wait 10 min.
6. Click on **[TB Temp]** to adjust the temperature.
7. Connect the multi-meter (-) on TP1 of board 17970/9 and the (+) onto TP6 on board 17970/8 CPU slave Cuvette Measurement System.
8. Check the voltage of +5,00 VDC ± 0,1.
9. To adjust the reference voltage use PR1 on board 17970/8 and read the temperature by clicking on **[TB Temp]**..

! A variation of ± 10mV corresponds to ± 0,5° C on the monitor).

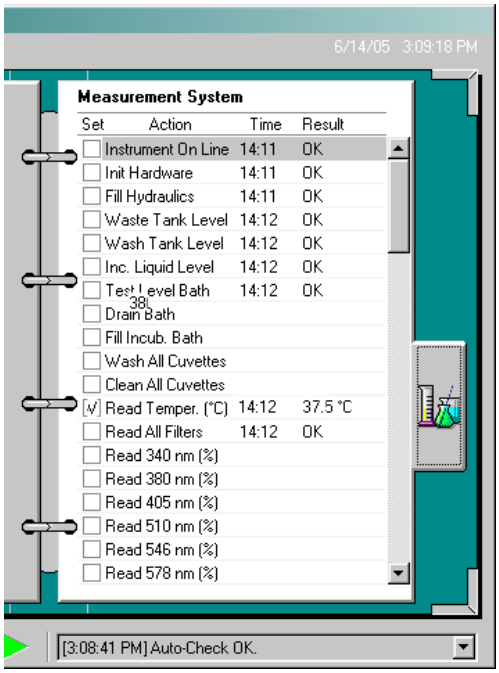
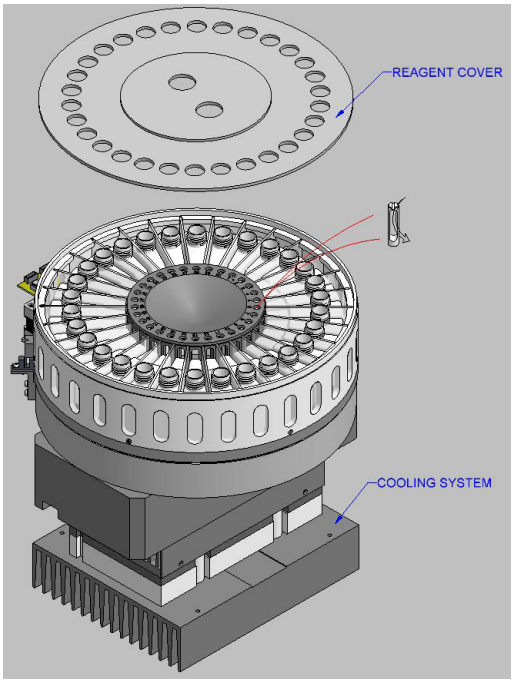

6/14/05 3:09:18 PM
Measurement System
Set Action Time Result
Instrument On Line 14:11 OK
Init Hardware 14:11 OK
Fill Hydraulics 14:11 OK
Waste Tank Level 14:12 OK
Wash Tank Level 14:12 OK
Inc. Liquid Level 14:12 OK
Test Level Bath 14:12 OK
Drain Bath
Fill Incub. Bath
Wash All Cuvettes
Clean All Cuvettes
Read Temper. (°C) 14:12 37.5 °C
Read All Filters 14:12 OK
Read 340 nm (%)
Read 380 nm (%)
Read 405 nm (%)
Read 510 nm (%)
Read 546 nm (%)
Read 578 nm (%)
[3:08:41 PM] Auto-Check OK.

FIGURE 57

The procedure is finished when the monitor displays a temperature of 38.5°C ± 1°C and on TP6 there is a value of +5,00 VDC ± 0,1.
Turn OFF the Analyzer and insert the Reaction Measurement System CPU Slave board into its place.

18.5.2 CHECK TEMPERATURE IN THE REAGENT CHAMBER

1. Make sure that the fans of the cooling radiator and that of the air recycling are working properly.
2. Insert a Reagent bottle with approximately 30 to 40 ml of dist. Water into the Reagent Chamber. Make sure that the cooling air vent is open. Close the chamber with its covers and wait 30 min.
3. Insert the thermometer into the Reagent bottle and measure its temperature.
4. The temperature of the water should be about 8 ÷ 10°C below that of the ambient temperature.



! This measurement should be made at least 20 min after the Analyzer has been ON.

The cooling system and the temperature will depend on the number of Reagent bottles present and the volume in those bottles.

If the cooling is not within the specs, check as follows:
1. Ambient temperature is below 25 C.°
2. An excess of dust has accumulated and is blocking the cool air from circulating.

18.6 Preparation System

The Preparation System consists in both:

1. Reagent System
2. Sampling System

! **Some of the operations have to be done using the Diagnostic Program Tester.exe**

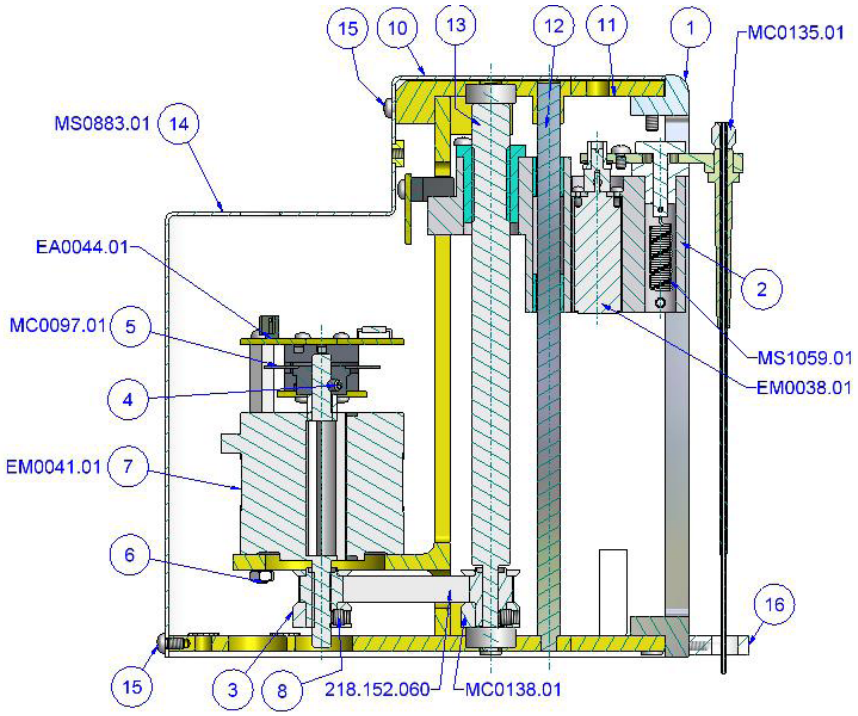
18.6.1 SAMPLING ARM, VERTICAL MOVEMENT (PROBE)

This procedure is valid for both the **Reagent** and the **Sampling Arms**.

18.6.1.1 To Check Electronic Alignment

1. Remove the Probe from its Arm.
2. Click on **[PWR ON]** on both Systems „Reagent“ and “Sample”.
3. Click in sequence on **[HOME Z], [HOME Plate], [HOME Arm], [HOME Diluter]** on the specific system.
4. At the end of homing, introduce the spacer device (D/3) „Figure 41“ to check the distance between the front panel (1) („Figure 50“) and the support of the Probe (2), if necessary proceed as follows:

FIGURE 58



18.6.1.2 To Align the Probe into Home Position

1. Remove the Probe and unscrew the tube.
2. Remove screws (15) then remove the Arm cover (14) „Figure 50“.
3. Loosen screw (4) (hexa key 1,5mm) to enable adjustment of the encoder disk (5).
4. Insert the spacer device (D/3) into the upper part of the support holding the Probe tube (2) to the front panel (1), by turning screw (13) with a screwdriver.

5. Rotate the encoder disk (5) until the **yellow LED** (DL3) is lit on the encoder board 17903/50. Tighten loosely screw (4) and remove spacer device (D/3).
6. Repeat the operation as described in „18.6.1.1 To Check Electronic Alignment“ and tighten the screws.
7. Replace the cover (14) and block it with screws (15). Replace the Probe with its tube.

18.6.1.3 Replace the belt and motor of Probe movement

Replacement of Belt:

! Operation to be made with Analyzer turned OFF.

1. Remove the Probe and its tube.
2. Remove screws (15) and the Arm cover (14).
3. Lower the Probe holder (2) to about half its length by rotating the screw (13) with a screw driver.
4. Loosen nuts (6) (key 5,5 mm) that hold motor (7) and release the belt.
5. Remove screws (10), remove the closure (11) and raise slowly the whole group (2 and 13) about 10mm. Replace the belt with a new original part.

Replace the motor:

6. Remove the connector from the driver board, remove the cable and the motor.
7. Disassemble the motor by removing:
   - The pulley (3) by loosening the screws (8) (hexa key 1.5 mm)
   - Screws and the encoder board 17903/50.
   - Encoder disk (5) by loosening the screw (4), and the spacer.
8. Reassemble the parts on the new motor, make sure the encoder board faces the right way (see „11 Encoder Motore“).

Reassemble everything and make sure to align the motor pulley (8) with that of the screw. Adjust the tension of the belt and lock it with nuts (6).
At the end proceed to align the Probe („18.6.1.2 To Align the Probe into Home Position“).

18.6.1.4 To Replace the Mixer Motor

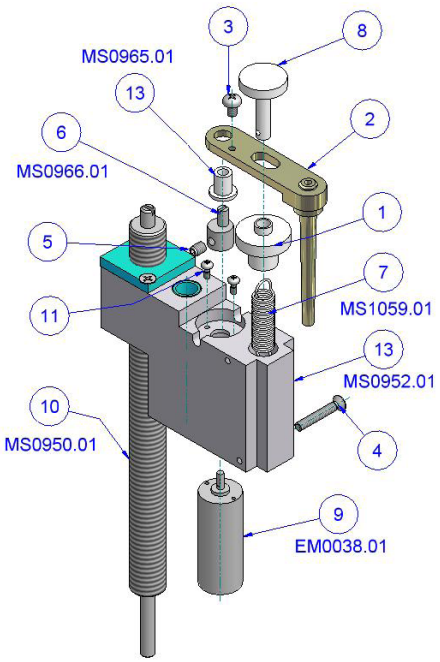
! Operation to be done with Analyzer turned OFF.

1. Follow procedure from 1 to 3 in „18.6.1.2 To Align the Probe into Home Position“ above.
2. Remove connector of the wire connected to the level sensor board (EB0124.02).
3. Lift the Probe holder (2) remove it from cam (6) and rotate it. „18.6.1.4 To Replace the Mixer Motor“.
4. Remove cam (6) by loosening screw (5) (key 1,5mm).

! Make sure not to loose the isolation O-ring (13), without it the Probe Liquid Level Sensor will not work.

5. Remove the motor screws (11) and replace the motor.
6. Reassemble everything.

FIGURE 59



At the end check the operation of the mixer using the Tester.exe program, by clicking on **[Mixer]**.

18.6.2 SAMPLING ARM, ROTATIONAL MOVEMENT

This procedure is valid for both the Sampling and Reagent Arms.

18.6.2.1 Check Electronic Alignment

The check described herewith depends on the correct Home position of the Cuvette Plate. If necessary align that plate first. (see „18.7.1.1 To Replace a single cuvette“).

1. Click on **[PWR ON]** section „Reagent „ or “Sample”.
2. Click in sequence **[HOME Z], [HOME Plate], [HOME Arm], [HOME Diluter].**
3. Click in sequence **[PWR ON] [HOME Z] [HOME Plate] [HOME Filter]** section Cuvette to verify its Home position.
4. In section to check Probe, enter “500“ into space “mm/10“ and click **[MOVE Z]** to lower the probe.

5. Click on **[MIXER]** and make sure that the probe does not touch the cuvette walls.
6. Click on **[HOME Z]** to bring back the probe to its Home position.
7. If necessary proceed to align the Arm. (see „18.6.2.2 To Align the Arm into Home Position“).

At the end check the probe inside the Reagent bottle inside the **Reagent plate** (see „18.6.3 Reagent Chamber“) and inside the **Sample tray** in one of the sample cups. (see „18.6.4 Sample Plate“).

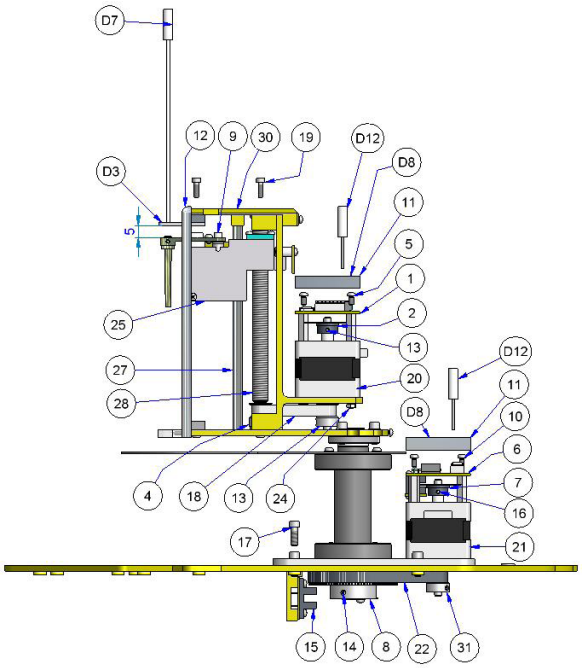
18.6.2.2 To Align the Arm into Home Position

The check described herewith depends on the correct Home position of the Cuvette Plate. If necessary align that plate first. (see „18.7.1.1 To Replace a single cuvette“).

! Operation to be done using the Tester.exe.

The present procedure is valid for both the **Reagent** as well as the **Sample Arms**.

1. Follow the procedure described in „18.6.2.1 Check Electronic Alignment“ from 1 to 6.
2. Loosen screw (16) of the encoder disk (7) so the disk is movable (hexa key 1,5mm) „Figure 52“.
3. Rotate manually the encoder disk (7) (see note).
4. Repeat the procedure in „18.6.2.1 Check Electronic Alignment“ from 2 to 6.



! To rotate the Arms, rotate the encoder disk in small steps. To rotate the Reagent Arm toward the Cuvette plate, rotate the encoder disk clockwise. To turn the Sampling Arm to ward the Cuvette plate, turn the encoder disk anticlockwise.

FIGURE 60

5. If necessary repeat operations from 2 to 4.
6. Tighten (slightly) the screw of the encoder disk (16).
7. Click on **[HOME Z]** to reposition the probe Home.

Operation to be done with Analyzer turned OFF.

18.6.2.3 Replace belt and motor of the Sampling Arm

The procedure is valid for both the **Sampling** and the **Reagent Arms**.

Replacement of Belt

1. Remove all connections between the Arm assembly and board 17970/20, 17970/21.
2. Remove the arm wiring from the panel (4).
3. Disconnect the Probe tubing from under the mechanical assembly.
4. Remove the four hexa screws (1) that hold the Arm assembly to panel (4). (use a hexa key 3mm) „Figure 53“.
5. Loosen the screws and the hexa nuts that hold the motor (21) to the Arm assembly. (see „Figure 52“).
6. Remove the belt (22) and replace it with an original one.
7. Reassemble as above in reverse.
8. Reconnect all wiring and tubing.
9. Realign the Arm (see „18.6.2.3 Replace belt and motor of the Sampling Arm“)

If necessary loosen screw (17) that holds the Opto Home assembly (15). Reposition the sensor with the flag of the pulley (8).

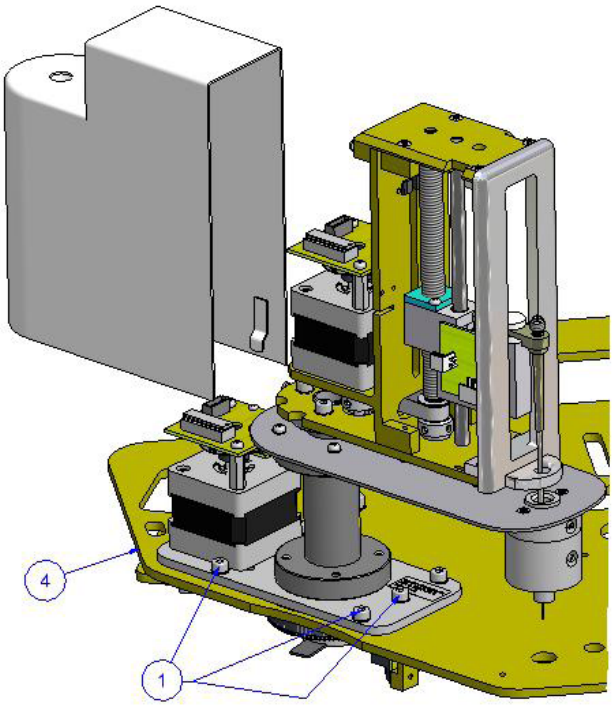


FIGURE 61

Replace the motor

1. Repeat the procedure as above from 1 to 4.
2. Remove the screws and the hexa nuts that hold the motor (21) to the Arm assembly („Figure 52“).
3. Dismount and remove the motor.
   - Pulley (31) loosening screws (use hexa key 1.5 mm)
   - Screws (10) and encoder board (6)
   - Encoder disk (7) loosening screw (16), and the spacer.
4. Reassemble all the parts onto the new motor, attention the side when mounting the Encoder board (6) („11 Encoder Motore“).
5. Reassemble the motor, attention to align the motor pulley (31) with the cam (8), do not tighten the screws and the nuts (23).
6. 1Pull the motor (21) and stretch the belt (22), Lock the screws and the nuts (23).
7. Reassemble in reverse as described above.
8. Reconnect the wiring and the tubing previously disconnected.
9. Realign the Arm (see „18.6.2.3 Replace belt and motor of the Sampling Arm“)

18.6.2.4 Align the Rotational Movement of the Sampling Arm

! Operation to be done using the Tester.exe.

1. Click in sequence, **in Cuvette Section only**, on **[PWR ON] [HOME Z] [HOME Plate] [HOME Filter].**
2. Replace the Probe with testing device (D/5) „Figure 52“.
3. Loosen blocking screw (16) enough to move the encoder disk (7).
4. Move manually the Arm assembly and position the device (D/5) exactly in the center of the cuvette.
5. Rotate the movement screw (28) using the a screwdriver, and lower the device into the cuvette.
6. Holding the Arm, rotate the encoder disk (7) until the yellow LED DL3 is lit on the encoder board (6).
7. Tighten (moderately) the holding screw of the encoder disk (7).
8. Remove device (D/5) and insert the probe.
9. Verify the electronic alignment of the arm (see „18.6.2.1 Check Electronic Alignment“).If necessary repeat procedure.

18.6.3 REAGENT CHAMBER

18.6.3.1 Verify electronic alignment

Operation to be done using the Tester.exe.

1. Click in sequence on **[PWR ON] [HOME Z] [HOME Plate] [HOME Arm] [HOME DIL]** in section „Reagents“.
2. Insert a reagent bottle into position 1.
3. In section arm check, select “Bottle 1“ in menù “Position” and e click **[MOVE ARM]**
4. In section check probe, enter “200“ in space “mm/10“(decimals of millimeter) and click **[MOVE Z]** to lower the probe.
5. Click **[MIXER]** and make sure that during the rotation the probe does not touch the collar of the bottle.
6. Click **[HOME Z] [HOME ARM]** to reposition the probe Home.
7. If necessary verify also the Arm alignment (see „18.6.2.1 Check Electronic Alignment“) or execute the alignment of the Reagent Chamber. (see „18.6.3.2 Alignment of the Reagent Plate“).

18.6.3.2 Alignment of the Reagent Plate

Operation to be done with Tester.exe.

1. Run all the operations as described in „18.6.3.1 Verify electronic alignment“.
2. Loosen slightly the holding screw of the encoder disk (2) (hexa key 1,5mm).
3. Move manually the Reagent Plate, by moving the motor pulley, and position the Reagent Bottle exactly under the Reagent Arm.
4. Rotate manually the encoder disk (2) until the yellow LED DL3 and DL7 are lit on the encoder board 17903/53 (1).

„Figure 54“ shows the position of flag (3) inside the Opto of Home (4) when the alignment is done correctly.

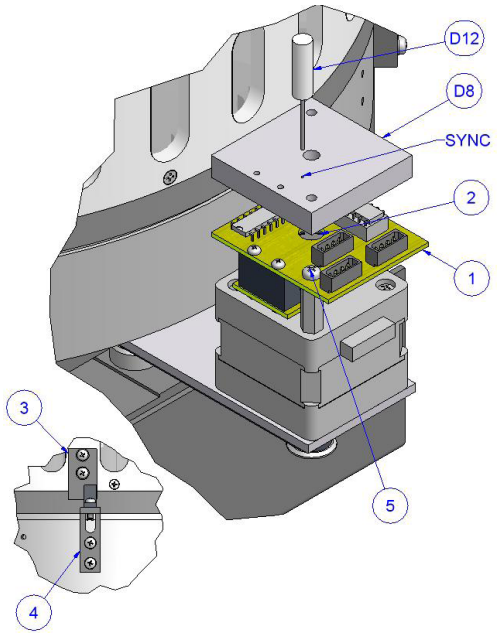


FIGURE 62

5. Tighten (moderately) the holding screw of the encoder disk (2).
6. Repeat the procedure to check the alignment as described in „18.6.3.1 Verify electronic alignment“.

18.6.3.3 Replacement belt Reagent Chamber

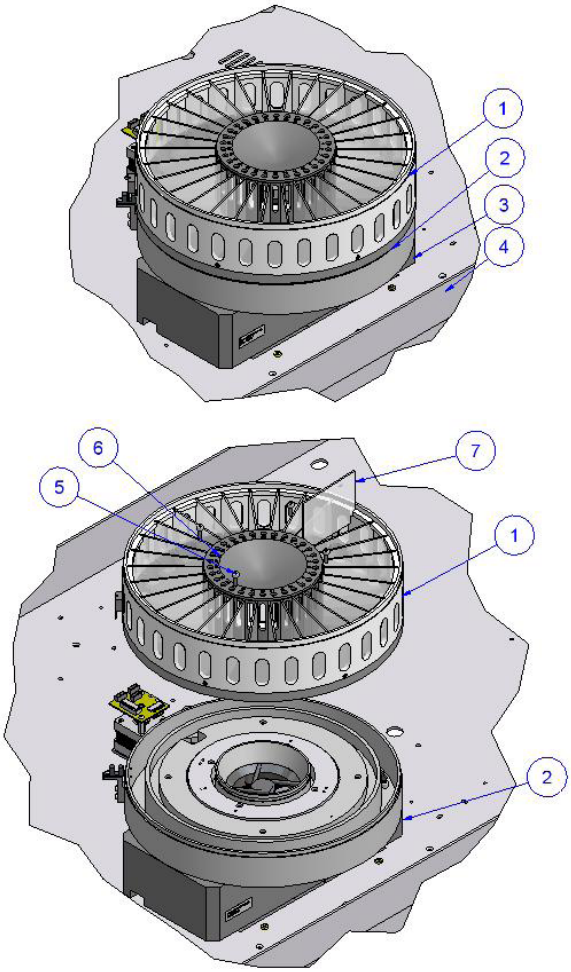
! Operation to be done with Analyzer turned OFF.

Remove all the reagent bottles from the plate.
The Reagent Chamber consists in the following parts: (see „Figure 55“ / „Figure 56“):

- Support reagent bottles (1).
- Holding screws.
- Analyzer chassis.
- Cooling Module.

FIGURE 63

1. Remove screws (5) that hold the reagent
2. plate (1) to support (3) (use hexa key 3 mm). If necessary remove cover (6) and the bottle separators (7) „Figure 55“.
3. Remove the reagent plate (1) from above.
4. Remove the connecting screw (17) between the ball bearing and the terminal of ground (use hexa key 2,5mm).
5. Remove screws (7) that hold the ball bearing (8) to support (2) and to the cog-wheel (9) (use hexa key 3 mm) „Figure 56“.
6. Remove the ball bearing (8).
7. Remove the connections from motor (15) and from the encoder board on the driver board EB0092.06.
8. Remove the holding screws (18) and support (2).
9. Loosen the two screws (14) (hexa key 3mm) and move the whole assembly in order to loosen the upper belt.
10. Replace belt (10) with an original one, making sure that the teeth are perfectly coupled with the pulley (11).
11. Insert the ball bearing (8) positioning it with the hole (6) in axis with pulley (11).
12. Tighten screws (7) (hexa key 3 mm).



13. Pull the support (16) to tighten belt (10) and tighten screws (14) (hexa key 3 mm).
14. Rotate manually the pulley (14) to check that the ball bearing is rolling freely and without impediments.
15. Reassemble the support (2), with screws (18), to the base (19).
16. Reconnect the wiring of motor (15) and the encoder onto the driver board EB0092.06.

At the end check the alignment of the Reagent Plate as described in „18.6.3.2 Alignment of the Reagent Plate“.

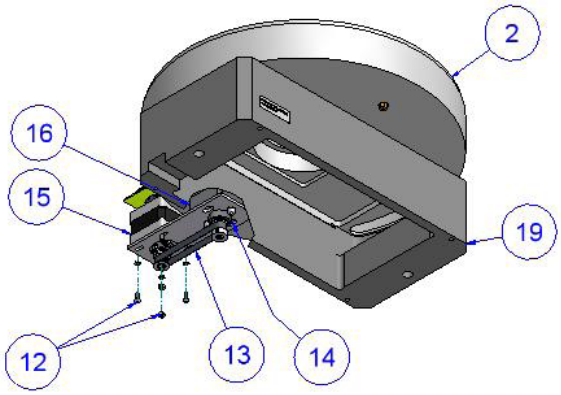
18.6.3.4 Replace belt and motor in Reagent Chamber

Operation to be done with Analyzer turned OFF.

Replace Belt:

1. Loosen the hexa screws and nuts (12) of the motor (15) „Figure 56“.
2. Loosen the belt (13) and replace it with an original part.
3. Pull the motor (15) to tighten the belt (13) and lock the screws and nuts (12).
4. Align the Reagent Chamber as described in „18.6.3.2 Alignment of the Reagent Plate“.

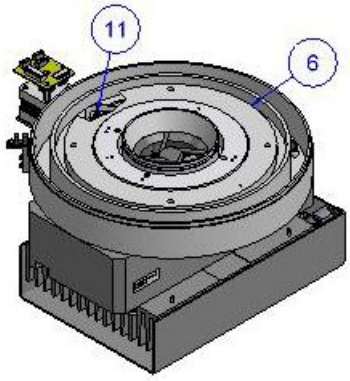
FIGURE 64



Replace the Motor:

5. Remove all connections from the motor (15) and from the encoder board on the driver board EB0092.06.
6. Remove the screws and nuts (12)
7. To extract the motor remove :
   - The pulley by loosening the screws (hexa key 1.5 mm)
   - Screws (5) and the encoder board (1) „Figure 54“.
   - The encoder disk (2) loosening the screws and the spacer.

8. Reassemble the parts on the new motor, make sure to mount the encoder board (1) correctly. („11 Encoder Motore“).
9. To reassemble the motor proceed in reverse, make sure to align the pulleys before tightening the screws and nuts (12) „Figure 56“.
10. Pull motor (15) and stretch the belt (13), tighten the screws and nuts (12).
11. Reconnect wiring to the motor (15) to the encoder board on driver board EB0092.06 previously disconnected.
12. Realign the Reagent Chamber as described in „18.6.3.2 Alignment of the Reagent Plate“.



18.6.4 SAMPLE PLATE

18.6.4.1 Check electronic alignment

! Operation to be done using Tester.exe.

1. Click in sequence **[PWR ON] [HOME Z] [HOME Plate] [HOME Arm] [HOME DIL]** on section “Sample”.
2. Insert a sample cup into position 1 of the sample tray.
3. In section Arm control select “sample 1” from menù “Position” and click **[MOVE ARM]**.
4. In section Probe control, enter “300“ into space “mm/10“, click **[MOVE Z]** to lower the Probe into the cup.
5. Click **[MIXER]** and make sure that when mixing, the probe does not touch the plastic sample cup walls.
6. Click **[HOME Z] [HOME ARM]** to reposition the probe Home.
7. If necessary, check also the alignment of the Sampling Arm.(„18.6.2.2 To Align the Arm into Home Position“).

Operation to be done with Tester.exe.

18.6.4.2 Mechanical Alignment of the Sample Tray

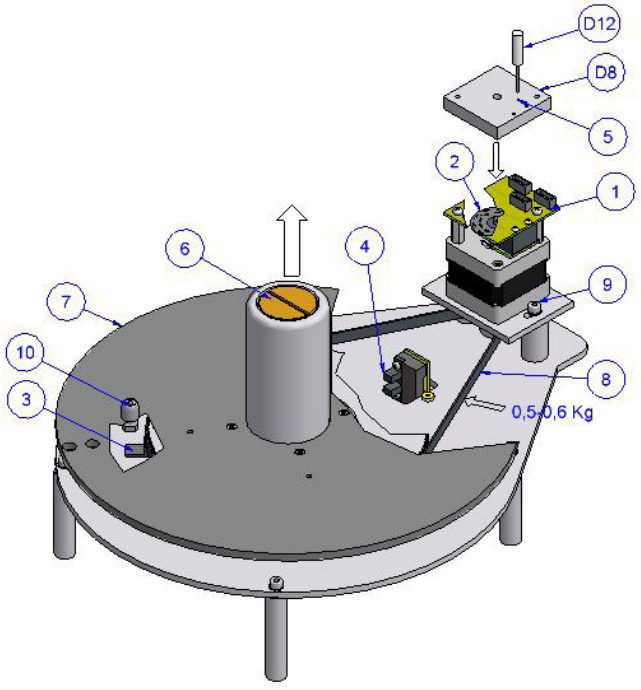
1. Follow all the procedures described in „18.6.4.1 Check electronic alignment“.
2. Remove the Sample Tray.
3. Loosen the holding screw of the centering Pin (10) (hexa key 3 mm) on the bottom of the plate (7) „Figure 57“.
4. Move the Pin (10) along the opening to align it.
5. Block the Pin and align the plate as described in „18.6.4.1 Check electronic alignment“.
6. If necessary proceed to align it electronically. (see „18.6.4.3 Electronic Alignment of Sample Tray“).

18.6.4.3 Electronic Alignment of Sample Tray

Operation to be done using the Tester.exe.

1. Follow all the operations described in „18.6.4.1 Check electronic alignment“.
2. Loosen the blocking screw to keep the encoder disk (2) under friction (hexa key 1,5mm).
3. Move manually sample tray (7), to align the flag (3) and the opto (4) as shown in „Figure 57“.
4. Holding tight the plate (7), rotate manually the encoder disk (2) (slowly) until the yellow LED DL3 and DL7 are lit on the encoder board 17903/53 (1).
5. Tighten (moderately) the holding screw of the encoder disk.
6. Check the alignment of the Sample Tray as described in „18.6.4.1 Check electronic alignment“.

FIGURE 65



18.6.4.4 Replace belt and motor of the Sample Tray

Operation to be done with Analyzer turned OFF.

Replace Belt

1. Remove the Sample Tray.
2. Remove the large screw (6) (using a screwdriver of 7 mm) „Figure 57“.
3. Loosen the two screws (9) that hold the motor.
4. Remove plate (7) from the top.
5. Replace belt (8) with an original part.
6. Reassemble the plate (7) and the motor panel, without locking screws (9).
7. Pull the motor assembly (the belt should not be excessively tight) and lock the screws (9).
8. Align the Sample Tray electronically (see „18.6.4.3 Electronic Alignment of Sample Tray“).

Replace Motor

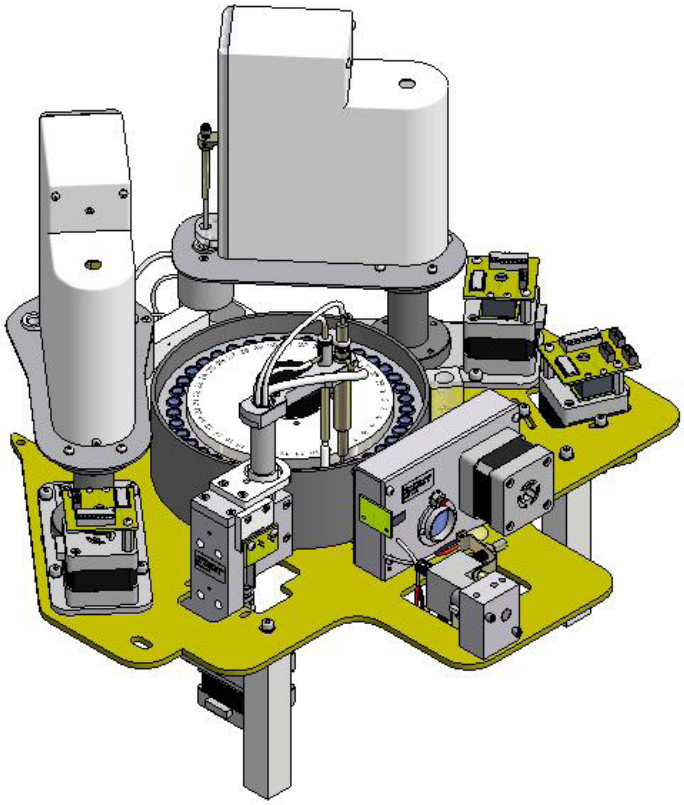
9. Remove all connection to the motor and the encoder board (1) on driver board EB0092.02.
10. Remove screws (9) that hold the motor panel.
11. Remove the screws and the nuts that hold the motor to its label.
12. Disassemble the motor by removing:

- The pulley by loosening screws the screws (hexa key 1.5 mm)
- The screws and the encoder board (1) „Figure 57“.
- The encoder disk (2) loosening the screws and the spacer.

13. Re-assemble the parts on the new motor making sure that the encoder board (1) is mounted correctly (see „11 Encoder Motore“).
14. Re-assemble the motor in the reverse, without tightening the screws (9) „11 Encoder Motore“.
15. Align the motor pulley with that of the plate.
16. Pull the motor to tighten the the belt (8), block screws (9).
17. Reconnect the wiring to the motor and the encoder board (1) on the driver board EB0092.02 previously disconnected.
18. Align the Sample Tray as described in „18.6.4.3 Electronic Alignment of Sample Tray“.

Before running this test, we suggest to check and to write down on the report sheet the photometric measurements of each of the 8 filters measured at the amplifier output. This will serve as reference before doing any technical repairs .

18.7 Measurement System



„Table 17“, serve to transcribe the values measured at the output of the first stage of the amplifier, suggest to make each measurement twice.

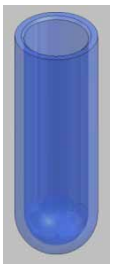
TABLE 19

Position	Filter nm	TP2 volt	Conversion A/D
1			
2			
3			
4			
5			
6			
7			
8			

18.7.1 CHECK REACTION AND MEASUREMENT PLATE

18.7.1.1 To Replace a single cuvette

1. Empty the incubation chamber in one of two ways:
   - Using Tester.exe click in sequence **[PWR ON] [HOME Z] [HOME Plate] [HOME Filter] [TB Drain]** in the cuvette section.
   - From Maintenance Program (F8) in Measurement System, click on **[Drain Liquid Bath]** (see „18.2.3 Reaction and Measurement System Checks“).
2. Remove screw (1) and turn the washing arm (2) to 180° „Figure 62“.
3. Remove knob (5) and the reference pin (4) „Figure 62“.
4. Insert pin (4) into one of the other holes and remove the plate (6) from above. Dry plate.
5. Remove the cuvette to be replaced, using the extractor device (D/1) „Figure 41“.
6. Wet externally the new cuvette and insert it.
7. Replace the cuvette plate and the washing arm into their original positions.
8. Fill the incubation chamber with **bi-distilled** water in one of the two ways:
   - Using the Tester.exe click on **[TB Fill]**, it will require two filling cycles.
   - From Maintenance (F8) click on **[Fill Liquid Bath]** (see „18.2.3 Reaction and Measurement System Checks“).



! Kit 17950 contains 5 calibrated cuvettes.

18.7.1.2 Replace the Cuvette Plate and Check Alignment

Replace the Cuvette Plate:

1. Follow operation 1 through 4 described in „18.7.1.1 To Replace a single cuvette“.
2. Replace the plate with a new one. Code MA0188.01 „Figure 58“.
3. Follow operation 7 and 8 in „18.7.1.1 To Replace a single cuvette“.

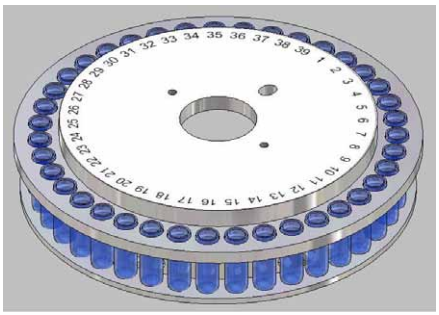


FIGURE 66

Operation to be done using Tester.exe.

Before moving the plate, make sure that the Washing Arm is in Home position, if necessary click [HOME Z].

Check Alignment:

4. Click in sequence **[PWR ON] [HOME Z] [HOME Plate] [HOME Filter].**
5. In section Washing Arm, enter "300" in the space "mm/10" and click **[MOVE Z]** to lower the arm into one of the cuvettes.
6. Make sure that the probe is exactly in the center of the cuvette, if necessary proceed to align the plate („18.7.1.5 Align the Cuvette Plate") or the Washing Arm (see „18.7.2.3 Alignment and Adjustment").
7. Run a photometric measurement of all the filters. If the values obtained are not within the Specs (see „18.4.3 Replace Motor and Belt."), realign the photometer lamp („18.4.2 To Equalize and Replace Filters").

18.7.1.3 Replace the Preamlifier

Operation to be done with Analyzer turned OFF. „Figure 65"

To avoid demages to the Analyzer, make sure that the preamplifier cord passes through the inside of the pulley.

1. Disconnect P1 from the Preamplifier from the converter board 17810/7.
2. Rotate manually the pulley (46) in order to align the window with the preamplifier (47).
3. Remove screws (30) and photometer (11) „Figure 62".
4. Remove screws (33) (hexa key 2.5mm) and extract the preamplifier (47). To facilitate the removal use pin (4) of the plate, by inserting it into the hole present on the container of the preamplifier.
5. Replace the assembly with an original and reassemble.
6. Re-assemble the photometer and execute a measurement on each of the filters. If the values obtained are not within the specs (see „18.4.3 Replace Motor and Belt."), proceed to realign the photometer lamp (see „18.4.2 To Equalize and Replace Filters").

18.7.1.4 Replace the Incubation Chamber „Figure 64" and „Figure 65"

Operation to be done with analyzer turned OFF.

1. Follow operations from 1 to 4 in „18.7.1.1 To Replace a single cuvette".
2. Remove screws (30) and the photometer (11) „Figure 62" and „Figure 65".
3. Remove screw (12) and the level sensor (13) „Figure 62".
4. Disconnect tubing (27) - (28) - (29) „Figure 65".
5. Loosen screws (9 and 10) (hexa key 3 and 4mm) to reduce tension on the belt (37) „Figure 62" and „Figure 65".
6. Remove pulley (46) by loosening screws (36).
7. Remove the center axis (35) „Figure 66".
8. Remove screws (28) and take out the Incubation Chamber (7).
9. Replace the Incubation Chamber (7) with a new one.
10. Re-assemble everything working in reverse.
11. Proceed to re-align mechanically the Cuvette Plate. („18.7.1.5 Align the Cuvette Plate").

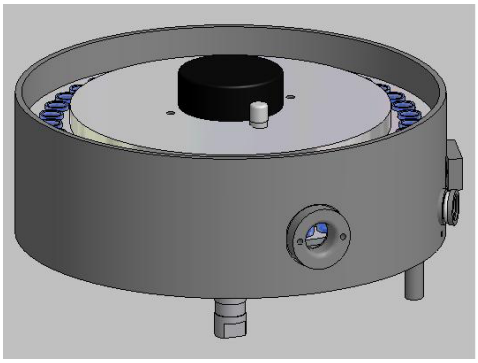


FIGURE 67

18.7.1.5 Align the Cuvette Plate

This procedure is divided into two parts:

- **Electronic alignment** - must be done each time one replaces the Cuvette Plate, the Wash Arm position remains always the same.
- **Pre-alignment mechanical**: has to be done each time the incubation chamber is replaced, the motor or the transmission belts.

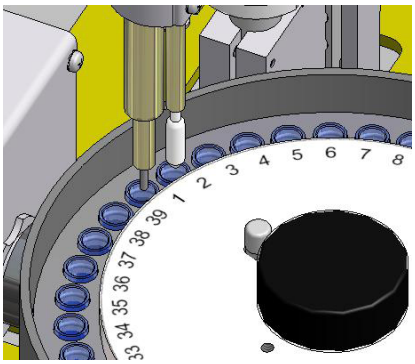
Electronic Alignment:

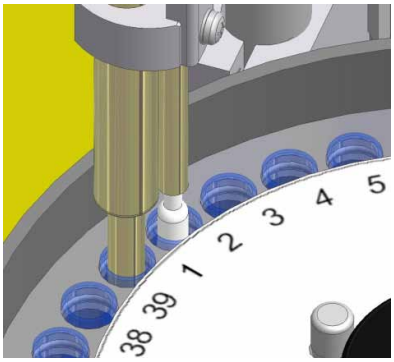
! **Operation to be done using the Tester.exe „Figure 60“.**

1. Click in sequence in section Cuvette **[PWR ON] [HOME Z] [HOME Plate] [HOME Filter]**.
2. Make sure that cuvette N°1 is positioned under the Air Probe of the Washing Arm.
3. In section Washing Arm control, enter “300“ into the space “mm/10“ and click **[MOVE Z]** to lower the Arm.
4. If the Probe touches the wall of the cuvette, proceed as below.
5. If the Probe is perfectly centered inside the cuvette, execute a photometric measurement of all the filters, making sure that the values obtained are within the required specs. (paragraph „18.4.3 Replace Motor and Belt.“), if necessary re-align the photometer lamp. (paragraph „18.4.3 Replace Motor and Belt.“).
6. Loosen the screw of the encoder disk inside board (16) so that the disk is under friction (hexa key 1,5mm) „Figure 67“.
7. Use the pulley (45) („Figure 67“) to move the Cuvette Plate to the exact center of the Probe.
8. Rotate slowly the encoder disk until the yellow **LED - DL3 and DL7** is lit on the encoder board (16).
9. Repeat procedure from 1 to 4 as above.
10. Tighten lightly the holding screw of the encoder disk.

11. Proceed to run a photometric measurement on al filters. If the values obtained do not enter the specs („18.4.3 Replace Motor and Belt."), re-align the photometer lamp. („18.4.2 To Equalize and Replace Filters").

FIGURE 68





Mechanical Alignment

Operatios to be done using Tester.exe

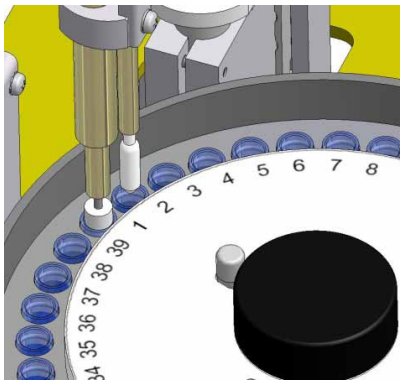
1. Click on [PWR ON] on all sections.
2. Click on Cuvette section on [TB Drain] to empty the incubation chamber.
3. When incubation chamber is empty, turn OFF the analyzer.

Operation to be done with Analyzer turned OFF.

4. Proceed with operations 2 to 4 as in „18.7.1 Check Reaction and Measurement Plate".
5. Remove cuvette N°38 from the plate using the extractor device D/1 („Figure 41").
6. Remove screws (30) and the photometer (11) „Figure 64"and „Figure 67".
7. Remove screws (15) and the encoder board (16) „Figure 64".
8. Loosen the encoder disk screw (hexa key 1,5mm).
9. Place device D8 in place of the encoder board (16). Rotate slowly the encoder disk to insert the device D12 into the hole. .
10. Loosen screws (36) of the pulley („Figure 65").
11. Screw in device D/11 into the hole of the plate axis.
12. Apply pressure towards the inside to remove the quartz window from the incubation chamber (lamp side)
13. Insert the cuvette plate and the reference pin (4), tighten knob (5) „Figure 64". Rotate the plate to align cuvette 38 with the light source.
14. Insert in place of the quartz window the device D/6 aligning it with the light source through cuvette N°38. Lock with two screws TCC M3x8.
15. Position the flag (38) in the center of the Opto to Home the cuvette plate.
16. Tighten the screws (36) of the pulley „Figure 67"and the encoder disk

! If the incubation chamber is full of bi-distilled water, proceed with operations 1 through 3. In the contrary go to point 4.

17. Remove in sequence:
- The screws and the device D/6.
- Device D/11 from the plate axis hole.
- Device D12 and device from the encoder board.
18. Remove knob (5) and the reference pin (4) „Figure 64“. Re-insert cuvette N°38
19. Re-insert la the encoder board (16), and screws (15) „Figure 64“.



Operations to be done using Tester.exe

20. Click in sequence **[PWR ON] [HOME Z] [HOME Plate] [HOME Filter]** in section cuvette.
21. Fill the incubation chamber with bi-distilled water by clicking on **[TB Fill]**, it will require two filling cycles.
22. Align the Cuvette Plate (see „18.7.1.2 Replace the Cuvette Plate and Check Alignment“).

18.7.1.6 Replace motor and belts of the Cuvette Plate

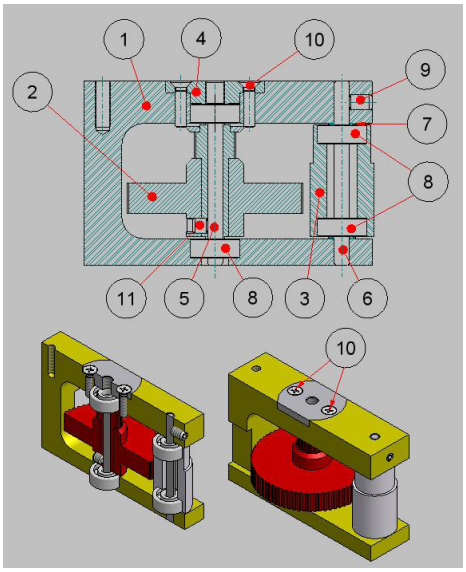
Replacement of Belts (37 - 40)

! **Operation to be done with analyzer turned OFF.**

1. Remove screws (9 and 10) (hexa keys 3 and 4mm), remove reducer (39) together with the two toothed belts (37 and 40) „Figure 64“ and „Figure 66“.
2. Remove the stud (4) by removing screws (10). Loosen screws (11) (hexa key 1.5 mm) and remove the axis (5) „Figure 61“.
3. Remove pulley (2). **Attention: there are two flat isolation washers.**
4. Replace the belts (37 and 40) „Figure 65“ with original ones.
5. Re-assemble the pulley proceeding in reverse.
6. Remount the reducer (39) on the photometer assembly and ad just the tension of the belt (37).
7. Adjust the tension of the belt (37) as follows:
8. Rotate the holder (39) counterclockwise to obtain flexibility in the center of the belt (39) of 2 mm with a pressure of 1 Kg, see „Figure 66“.

9. Tighten screws (9 and 10).
10. Proceed to pre-align mechanically as described in „18.7.1.5 Align the Cuvette Plate“.

FIGURE 69



Replace Motor

11. Remove screws (15) and encoder board (16) „Figure 64“.
12. Remove the connection of the motor from the driver board 17970/20.
13. Remove the wiring from the motor.
14. Remove the holding screws (14) and the motor assembly (hexa key 3 mm).
15. Remove screws and nuts (43) and remove the motor from the plate (42) „Figure 66“.
16. Disassemble the motor by removing:
    - Pulley (45) by loosening the screws (hexa key 1.5 mm).
    - Encoder disk by loosening the screw, and the spacer.
17. Re-assemble the parts on the new motor.
18. Remount the motor onto its plate (42) „Figure 66“, do not tighten screws (14) „Figure 64“.
19. Adjust the height of the motor pulley (45) so that the belt is aligned with the pulley (41) of the reducer (39) „Figure 66“.
20. Pull the motor to tighten the belt (40), tighten the screws (14).
21. Reconnect the motor to the driver board 17970/20.
22. Restore the encoder board (16) with screws (15), watch the encoder board (1) side when mounting (see chapter 11).
23. Proceed to the mechanical pre-alignment described in „18.7.1.5 Align the Cuvette Plate“.

18.7.1.7 Removal of the Measurement System

! Operation to be done using the Tester.exe.

24. Click on **[PWR ON]** on all three sections.
25. Click in Cuvette section on **[TB Drain]** to empty the incubation chamber.

When empty – turn OFF the analyzer.

! Operation to be done with Analyzer turned OFF.

1. Remove the hydraulic connections
   (see hydraulic schematics HY0012.01 – Chapter 16):
- Tubing (20) (21) (50) from chamber (65)
- Tubing (8) (11) from container (64)
- Tubing (12) (13) (16) from connector (81) (see also „18.7.2.3 Alignment and Adjustment“)
- Tubing (3) from connectors (5)

2. Remove the following electronic connections (see Chapter 3 – Block Diagram EI0110.01):
- Connector P1 from pre-amplifier from A/D converter board 17970/19.
- Connectors from modules: Cuvette Plate – Photometer – Washing station – Sampling and Reagent Arm rotation – Sampling and Reagent Probes including their driver boards.
- connector P1 level sensor incubation chamber.
- Connector P1 lamp from power supply board 17970/10.

3. Remove screws (32) (hexa key 4mm) „Figure 66“.
4. Remove with care the Measurement System from above.

18.7.2 CUVETTE WASHING ARM

18.7.2.1 Check alignment of the Washing Arm

Before proceeding with the below operations, make sure that the Cuvette Plate is aligned correctly as described in „18.7.1.5 Align the Cuvette Plate“.

! Operation to be done using Tester.exe.

1. Click in sequence, in Cuvette section on **[PWR ON] [HOME Z] [HOME Plate] [HOME Filter].**
2. Make sure that cuvette N°1 is under the AIR probe of the of the Washing Arm.
3. In section Washing Arm control, enter “300“ in the space “mm/10“ and click **[MOVE Z]** to lower the arm.
4. If the probe touches the cuvette wall, align the Washing Arm (see „18.7.2.3 Alignment and Adjustment“).
5. If both Washing Probes are centered in the cuvettes, proceed to test the operation of the Washing Station in a working cycle (paragraph 16.7.2.2).

Operation to be done using Tester.exe.

18.7.2.2 Washing Station Operation Check

1. Program a Work List for 40 samples using a single reagent. Use dist. Water for both reagent and sample.
2. Run the Work List.
3. When completed, check each cuvette bottom, that no liquid residues have remained after the wash. Use a 50 µl pipette and aspirate each cuvette bottom. Maximum residue 10 to 15 ml).
4. If residue is more then 15 ml, see the “Trouble Shooting Guide” in Chapter 16, and check the Washing Arm alignment in chapter 18.7.2.1.

18.7.2.3 Alignment and Adjustment

Operation to be done using Tester.exe.

This up movement of the Probes is due to the correct operation of the spring built inside the Probe to compensate an eventual difference in cuvette height. If not, check the efficiency of the springs and make sure that the Washing Arm support is positioned all the way to touch mechanically its base (11) „Figure 63“.

1. Click in sequence, in section Cuvette, on **[PWR ON] [HOME Z] [HOME Plate] [HOME Filter]**.
2. Make sure that support (2) of the Washing Arm is parallel with line (15) of the hole on the measurement panel (9) „Figure 62“ and „Figure 63“.

If necessary loosen screws (12) and correct the alignment.

3. In section Washing Arm check, enter “300“ into space “mm/10“ and click **[MOVE Z]** to lower the Arm.
4. Loosening the screws (3) center with precision the AIR probe inside the cuvette.
5. In section Wahing Arm check, enter “370“ into space “mm/10“ and click **[MOVE Z]**.
6. Make sure that the two Probes when hitting the bottom of the cuvette, go up 1 -2 mm.
7. At the end check the proper operation of the Washing Arm. („18.7.2.2 Washing Station Operation Check“).

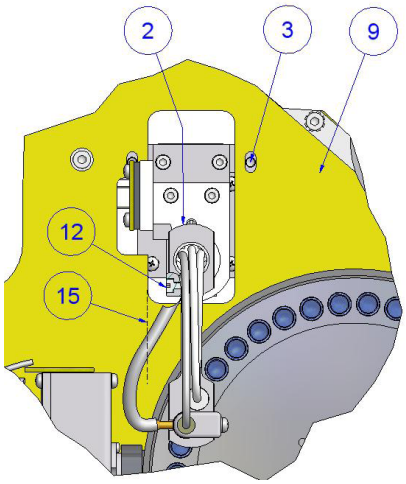


FIGURE 70

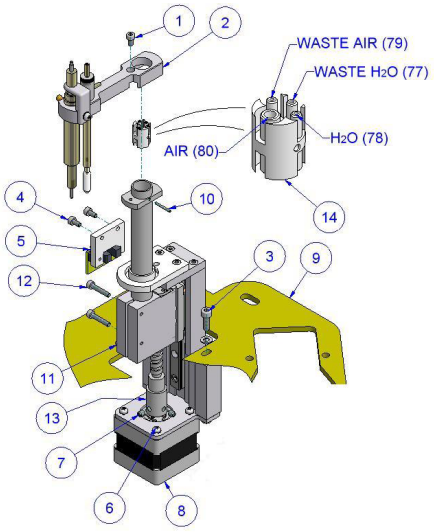


FIGURE 71

18.7.2.4 Replace the Washing Arm Motor

! Operation to be done with analyzer turned OFF.

1. Remove the tubing from the Washing Probes.
2. Remove screw (1) and the Washing Arm (2) „Figure 63“.
3. Remove with a pointed tool the blocking pin (10) and take out from above the device (14). Disconnect all the internal tubing.
4. Remove the wiring from motor from the driver board 17970/23. Remove the wiring from the motor cable.
5. Remove screws (4) and the Opto support (5).
6. Rotate screw (13) counterclockwise in order to lower the arm support (11) all the way down, it will be necessary to facilitate the removal of the assembly.
7. Remove screws (3) and take out the assembly from below the measuring system (9).
8. Loosen screws (7) (hexa key 2mm).
9. Remove screws (6) and the motor (8). Replace it with a new one.
10. Re-assemble the new motor (8) on its support and screw (13) without blocking the screws (7).
11. Insert screw (13) alongside the ball bearing.
12. Rotate screw (13) counterclockwise in order to lower the arm support (11) all the way down.
13. Block screws (7) and re-assemble everything onto the measurement panel (9) following the operations in reverse.

To reconnect all the tubing see the hydraulic schematics HY0012.01 in Chapter 16 and „Figure 63“.

Mechanical Alignment

14. Insert device D/2 (with the small hole in the up position) into cuvette N°1.
15. Position cuvetta N°1 under the AIR probe of the Washing Arm (Home position of the plate).
16. Make sure that the support (2) of the Washing Arm, is in parallel with line (15) of the hole on the measurement panel (9) „Figure 65“. If necessary loosen screws (12) and correct the alignment.
17. Lower support (11) by moving the screw (13) (use a 3mm screwdriver) by means the hole into the plastic support positioned on the top.
18. Align the Probes by adjusting the screws (3).
19. Finished the mechanical alignment, check as described in „18.7.2.1 Check alignment of the Washing Arm“.

! **It might be a good idea to repeat this cleaning a couple of times.**

18.7.2.5 Cleaning and Washing the inside of cuvettes

Operation to be done using the Maintenance Program F8

Cleaning the Cuvettes Internally

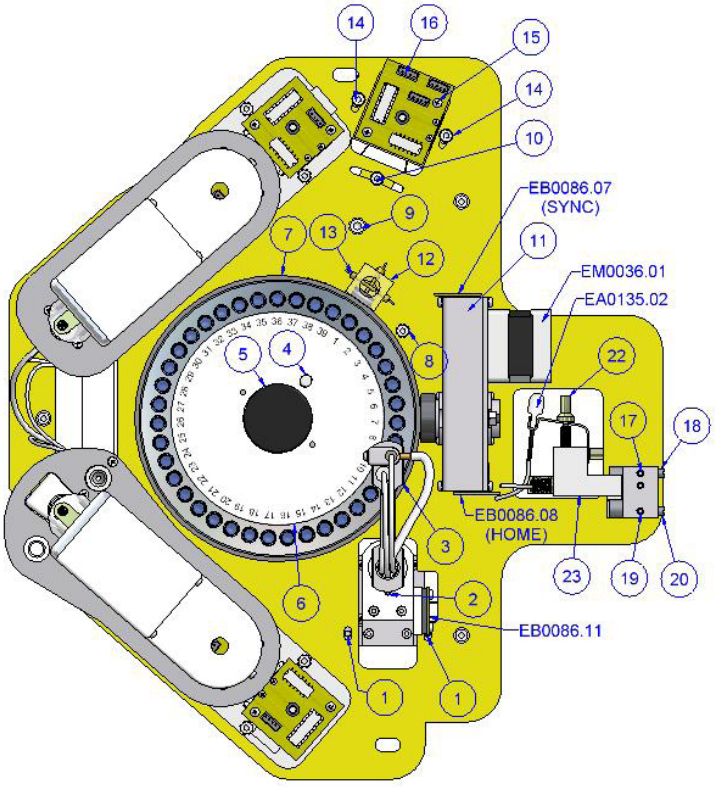
1. Fill a clean Reagent Bottle with 40 ml of EXTRAN Neutral (or any Lab detergent used for glassware) and place it into position 1 on the Reagent Plate.
2. In Maintenance (F8) from Measurement System, activate **[Clean All Cuvettes]** („18.2.3 Reaction and Measurement System Checks“).
3. The program will automatically fill all cuvettes with 500 µl of the detergent, leave it for 15 min at 37°C, and then wash all cuvettes with Washing Solution.

To Wash the Cuvettes internally.

1. In Maintenance (F8) from Measurement System, activate **[Wash All Cuvettes]** („18.2.3 Reaction and Measurement System Checks“).
2. The program will automatically wash all the cuvettes using the standard Wash Solution.
3. If after the wash cycle there are traces of water residue on the bottom of the cuvettes, proceed to eliminate as described in „18.7.2.1 Check alignment of the Washing Arm“.

FIGURE 72

Top View-Measurement System



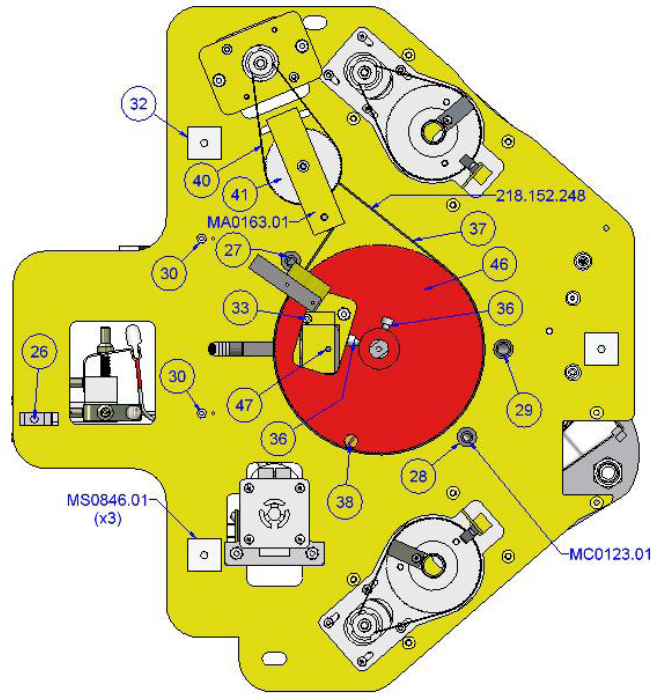


FIGURE 73
Bottom View-Measurement System

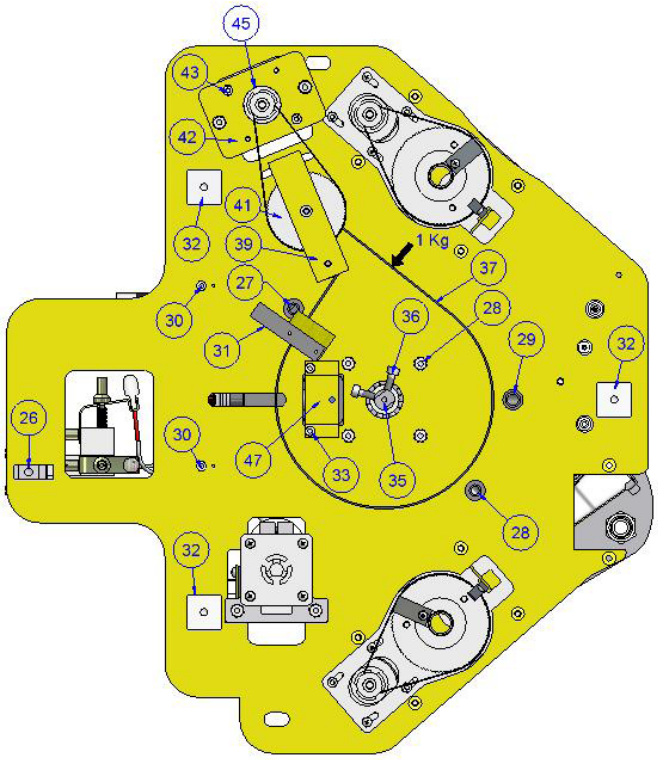
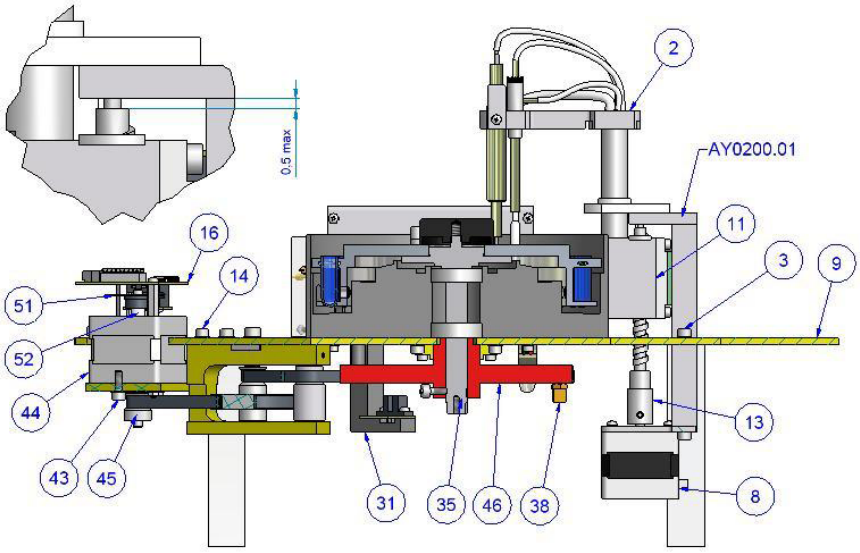


FIGURE 74
2° Bottom View- Measurement System

FIGURE 75
Side View-Measurement System



18.8 Programmed Maintenance

18.8.1 DAILY CHECK

1. When turned ON, the analyzer executes the following operations:

- Filling all the Hydraulic lines – all the tubing are filled with Wash Solution and the Reagent and Sampling Probes are washed and dried.
- Check presence of Wash Solution in its container.
- Check liquid level in incubation chamber (if necessary it will be automatically added).
- Check liquid temperature inside the incubation chamber.
- Measurement of a Water Blank on each filter to check the photometric Zero

When all checks are done correctly, the green START ▶ triangle becomes active.

2. Procedure to TURN OFF the Analyzer.

- Click on **[File]** displayed on top in the Operative Program.
- Click on **[Exit]** and confirm with **[yes]**.

Before shut Down, the program washes all the cuvettes and the Sampling Probes.

3. In case of a Fatal Error (see Chapter 17 – „17.1 Description“), the shut down of the analyzer may not be correct. In that case, when turned ON the system will wash all the cuvettes before doing the initial start-up checks.
4. The daily maintenance requires the following:

- Empty the WASTE container.

- Fill the Wash Solution Container with freshly prepared WASH solution, using a good quality distilled water. Bad quality water generates errors in the Liquid Level Sensors of the Probes and consequently also in results
- Check the liquid level in the container for the incubation chamber, if necessary add.
- If ISE Module is installed – check the level of Calibrator A.
- At the end of the working day, remove all the reagents bottles that require refrigeration and place them into the refrigerator. When the analyzer is turned OFF, the Reagent cooling system is also OFF.

18.8.2 EVERY TWO WEEKS

Replace the Liquid in the Incubation Chamber

1. From Maintenance Program (F8) in Measurement System activate **[Drain Liquid Bath]** (see „18.2.3 Reaction and Measurement System Checks“).
2. Make sure that the Liquid container for the bath is full.
3. Activate **[Fill Liquid Bath]** („18.2.3 Reaction and Measurement System Checks“).
4. Suggest to run the program **[Clean all Cuvettes]** see („18.7.2.5 Cleaning and Washing the inside of cuvettes“).
5. The frequency to “Clean All Cuvettes” depends on the type of chemistries that are being performed. In some cases a weekly cleaning is highly recommended.

18.8.3 ONCE A MONTH OR WHEN NECESSARY

Clean Cuvette plate and incubation Chamber

! Operation to be done with Analyzer turned OFF.

1. Empty Incubation Chamber as described in point 1 of „18.7.2.1 Check alignment of the Washing Arm“).
2. Remove the cuvette plate as described in points 2 through 4 in „18.7.1.1 To Replace a single cuvette“.
3. Clean the inside of the chamber with a clean rag, especially the two quartz windows of the photometer, if necessary use alcohol. Refill the Chamber with fresh bi-distilled water.
4. Place the cuvette plate into a solution of EXTRAN Neutral (or any other Lab detergent for glassware) making sure that all cuvettes are filled with the detergent, for couple of hours or a whole night.
5. Rinse the Plate and the cuvettes several times with distilled water. Replace the plate into the incubation chamber.

6. Run at least twice “Wash all Cuvettes” see „18.7.2.5 Cleaning and Washing the inside of cuvettes“.

18.8.4 EVERY SIX MONTHS OR WHEN NECESSARY

Check the condition of all the pump tubing inside the peristaltic pumps, located under the Diluters and the manifold. Change them if necessary. The usage of the tubing is directly proportional to the amount of work done on the Analyzer.

18.8.5 REPLACE PHOTOMETER LAMP

Replace the lamp as described in the Maintenance Program.

The Analyzer has built-in two lamps, to make it simple in case the first lamp burns out. To activate the second lamp follow the simple instructions described in „18.4.1 Photometer“.

We suggest to replace the burned lamp as fast as possible. **Before replacing the lamp clean the optical lenses with a solution used to clean eye glasses or eye lenses.**

18.8.6 PROGRAMMED MAINTENANCE TABLE

This Table indicates the maintenance operations required by the different Modules.

TABLE 20
Maintenance Program

Operation	15 dd	30 dd	4 mo	6 mo	1 yy	2 yy
Replace liquid in Incubation Chamber	•					
Clean Incubation chamber		•				
Clean cuvettes			•			
Replace Syringe type 4 and 5 (cylinder and piston)				•		
Replace Pump tubing, pumps P 3, P7, P8			•			
Replace Pump tubing pumps P1, P2, P4, P5				•		
Replace the pump crown on pumps P3, P7, P8					•	
Replace pump P6					•	
Replace Photometer lamp			•			
Clean Optic System					•	
Check Probe alignment				•		

Check diluter		•
Check cuvettes		•
Check Washing Probes and Incubation Chamber	•	
Clean Probe Washing station	•	
General Cleaning and check all pump tubing		•
Replace the level sensor flat cable		•

19 GENERAL TROUBLE SHOOTING GUIDE

This section describes some of the problems that can be encountered on **Huma-Star 300**, and how to solve them. To make it easy, this guide has been divided into problem categories. In many cases it will be referred to the section and its specific Trouble Shooting Guide.

! Trouble Shooting Guide – will be referred to as "T.S.Guide"

In some cases it will be necessary to use the "**TESTER exe**" which is part of the Diagnostic Program the "**HUMASTAR 300 TOOLS**".

19.1 Problems with Power Supply

Defect Found	To solve see:
Analyzer does not turn ON.	chapter 3 "T.S.Guide"
Fuses burn easily.	
Computer does not turn ON.	
Missing power +/- 23V	
Missing power + 5V	
Missing power + 12V	
Missing + 24V in Reagent System	
Missing + 24V in Measurement – Cuvette System	
Missing + 24V in Sample System	

19.2 Problems with Master Computer and its CPU Slaves

Defect Found	To solve see:
During routine operation, sometimes the analyzer Re-Starts	chapter 14 "T.S.Guide"
Program is slow to log in	
Mouse pointer blocks itself	
BIOS program does not recognize the HDD parameters, and displays the Warning: **DISK BOOT FAILURE.....**	
BIOS program does not recognize the FLOPPY DISK driver, and displays a warning: **FLOPPY DISK FAIL.....**	
IMPOSSIBLE to save data on the Floppy Diskette	
System Clock does not keep time	
Printer does not work	

When turning ON the Analyzer, no acoustic (beep) is heard from the CPU slave The Master CPU (Pentium) does not communicate with the CPU slaves. There are malfunctions during routine operation as well as when using the Diagnostic Program.	chapter 6 “T.S.Guide”

19.3 Problems with Diluter

Defect Found	To solve see:
Diluter does not work	chapter 4 “T.S.Guide”.
Syringe piston does NOT move. Syringe piston does irregular movements and blocks itself. Diluter does NOT operate with the Diagnostic Test Program.	chapter 7 “T.S.Guide”

19.4 Mechanical Movement Problems

Defect Found	To solve see:
Reagent ARM, Sampling ARM and Cuvette plate do NOT move Cuvette Washing Probes and Cuvette plate do NOT move. Filter Wheel does NOT move.	chapter 8 “T.S.Guide”
During HOME positioning of the following movements, there are problems: HOME Cuvette Washing Arm HOME Cuvette plate HOME filter wheel SYNC filter wheel HOME probe of Sampling Arm HOME slider Sampling Arm	chapter 13 “T.S.Guide”.

19.5 Temperature Problems

Defect Found	To solve see:
Program indicates a **WARNING** on temperature in incubation bath Temperature in incubation bath is NOT within the specifications. Temperature of incubation bath displayed does NOT correspond to that measured with a thermometer.	Section 4 “T.S.Guide””
Thermostat does NOT heat. Temperature in the incubation bath does not reach its optimum temperature. Temperature in thermostat is too high. Temperature inside incubation bath is too high.	Section 13 “T.S.Guide””

19.6 Problems with Photometer, Pre-Amplifier and lamp

Defect Found	To solve see:
Photometer Lamp is NOT ON Lamp voltage is not according to specs Lamp voltage is NOT stable Lamp burns the minute it is connected to its board.	Section 3 “T.S.Guide”
Output signal from preamplifier is OUT of specs (<< 0,7 V) Output signal from preamplifier does NOT change, it remains fixed at a given value, negative or positive. Output signal from preamplifier is NOT stable Absorbance value measured with Diagnostic Program varies ± 5 mAbs (out of range) Using the Operating System to calibrate the photometer lamp, it is impossible to obtain a value of > del 70% of transmittance	Section 7 “T.S.Guide”
Photometer filter wheel does not turn.	Section 4° “T.S.Guide”

19.7 Problems with unreliable results

Defect Found	Cause and Remedy
Absorbance of Water Blank is too HIGH	- Wash Solution used is old or dirty, check and prepare a fresh solution - Make sure that wash solution is dispensed into cuvette - Repeat Water Blank Measurement using the Maintenance F8 – program. - Dirty cuvettes, try cleaning and washing them, or simply replace with a new set. - Check photometer lamp alignment - Liquid in incubation bath is dirty, change it with fresh bi-distilled water.
Insufficient reproducibility.	- Check the thermostat and the liquid in the bath are clean, Drain bath and Fill with fresh bi-distilled water. - Clean and Wash cuvettes - Make sure the Probes are not blocked. - Check all tubing connections (probe, Cuvette Washing Arms, peristaltic pumps and syringe) - Make sure that the syringe piston does not leak and the O-ring holds hermetically. - Check connection and tubing of pump P1. - Check Photometer lamp, if necessary change it. - Check parameters of the method used, Reagent and Sample volumes, filter, type of measurement and incubation time.

Bad Linearity	- Make sure that the reagent volume is at least 300µ.l - Make sure that the Reagent bottles are clean and the reagent id freshly prepared. - DO NOT add fresh enzymatic reagent into a bottle with old reagent. Make sure enzymatic reagents are freshly prepared and place into clean bottles. - Make sure that the Wash Solution is freshly prepared (Clean all probes and the cuvettes) - Make sure that the Mixed works properly - Photometer lamp not properly aligned, check and re-align. - Low signal from the preamplifier board. Make sure that the output signal from the preamplifier under optimum conditions is between +0,7 and +1,4 V. - Check method and make sure that the reagent and sample volumes are correct, filter, type of measurement and incubation time.
Results are HIGH	- Repeat calibration for all those methods - Check method parameters - Standards and Calibrators maybe old, try with fresh and new ones - Check the Factors that are being used. - Check incubation temperature (if enzymes kinetics are too high)
Results are LOW	- Same as above. - Check the incubation temperature - Make sure that the Reagents, Standards, Calibrators and the Samples are fresh - Repeat calibration of method.
Serum Controls are NOT within the expected Range.	- Check expiration date of the Serum Controls - Check method, it may have been programmed badly. - Make sure the values refer to the method and reagent specs supplied by that reagent manufacturer. - Make sure that the serum controls are not deteriorated. - Repeat the test using an alternative method or different reagent - If substrate depletion, dilute sample and repeat calibration with freshly prepared reagents and standards.

Contamination	- Sampling and Reagent Probes are leaking, check the tubing connections from Diluter to the Probes. - Check the Syringe piston for leaks. - Dirty cuvettes, clean with detergent and then with wash solution - Cuvettes are not washed properly, check the Washing Arm. Make sure there is no residue in the cuvettes after wash. - Make sure that the Air pump works properly - Make sure that the Cuvette Washing Probe does not leak. - Make sure that the cuvette washing probes are well centered inside the cuvettes. - Make sure that the liquid drainage works properly.
Drift	- Check the stability of the photometer lamp, if necessary change it. - Check the temperature stability of the incubation bath . - Make sure that the reagents are freshly prepared.

19.8 Preparation Problems

Defect Found	Causes and Remedy
Diluter does NOT start.	- Syringe piston does Not move. Check it using the Maintenance Test.
When Syringe piston is moving, there is a mechanical noise.	- The moving parts need lubrification. Use a tiny quantity of oil.
Diluter does NOT aspirate or dispense	- Check tubing connections and the syringe piston - Probe not connected properly - Probe is blocked, clean - Wash Solution container is empty - Syringe and piston deteriorated.
Hydraulic tubing is not filled properly.	- Make sure there is Wash Solution in the container. - Check for piston leaks or badly held tubing connections. - Remove syringe, clean it or replace it.

Leaking Syringe	- Check piston - Check O-ring - Check the input and output of all tubing - Make sure the Probe is not blocked - Replace syringe with piston
Air bubbles inside the syringe	- Make sure that the piston is airtight inside the syringe - Make sure that the Wash Solution is properly prepared, with densioactive Tween 20 (one drop per liter of dist. Water)
Air bubbles present in tubing, syringe and probe.	- Make sure that the connecting tubing to the syringe are not bent. - Bent or torn tubing, replace - Check connection to the probe - Peristaltic pump P1 tubing is damaged, replace.
Tubing connected to Probe is empty.	- Make sure that the O-ring on the syringe is airtight. - Check if the Wash Solution container is empty. - Check tubing, if necessary change. - Make sure that pump P1 operates correctly.

19.9 Problems with level sensors and mixer

Defect Found	Cause and Remedy
The Sampling Level Sensor does not always work properly.	- **See chapter 12° "T.S.Guide"** - If volume in sample cup is too low, air bubbles enter the system and will produce errors in the level sensor. Make sure there is enough sample in cup. - Dirty or sticky probe, clean - Air bubbles or foam in the sample. - Wash solution has too much foam. Check and prepare a new lot.

Reagent level sensor does not always work properly.	- See as above for Sample - Do NOT shake the reagent when preparing, swirl gently, and it slowly stabilize. Shaking reagent creates bubbles and foam that disturb the normal operation of the sensor. - Make sure that the reagent bottle is NOT TOO FULL. Reagent should be below the narrow neck when the level sensor enters the bottle.
Level Sensor does not work	- **See chapter 12° "T.S.Guide"** - Probe enters liquid (Reagent or Sample) and gives an error " No sample or no Reagent". Make sure that the connection between board EB0124.XX and the Probe are done properly. - Bad isolation between the Probe and the board. See above - Replace cable WC0101.XX
Probe moves stepwise	- **See chapter "T.S.Guide"** - Prepare a fresh wash solution.
No flag or Warnings when missing liquid in Wash Solution container	- **See chapter 12° "T.S.Guide"** - Check contact and connector - If continues, remove the closure, wash it with dist. Water and dry it.
WARNING, message in "level Incubation bath"	- See chapter 6° "T.S.Guide" - Sensor that checks the level is dirty or broken, if necessary replace. - Go to Maintenance and select "Fill Bath" - Make sure that pump P4 and valve V1 are both working well.

Defect Found	To solve see:
NO WARNING flags are given on the following errors: liquid level Incub. Bath **(INCUB)**, liquid level of Wash solution **(WASH)**, level in waste container **(WASTE)** The above flags **-INCUB**, **WASH** and **WASTE** - work on Mother Board, but operating program does not display **WARNING** **NO WARNING** on incub. Bath level **(TB HIGH)** Flag TB HIGH works on Mother Board, but no signal is displayed. **NO WARNING** incub. Bath level **(TB LOW)** Flag **TB LOW** works on Mother Board, but is not displayed.	Section 4 “T.S. Guide”.
Mixer does not work	chapter 12 “T.S. Guide”.

19.10 Problems Cooling System

Defect Found	Causes and Remedy
Cooling System does NOT cool	See chapter 3 and 15 “T.S. Guide”

19.11 Problems with Thermostat

Defect Found	Causes and Remedy
Temperature in Incub, bath does NOT reach its optimum.	- Wait a few minutes – then check in Maintenance by activating “**Read Temp. °C**”
Thermostat does NOT heat	- See chapter 3 - “T.S. Guide”.
Temperature in incub. Bath is too high. **Liquid does NOT circulate**	- See chapter 16° - General Maintenance. Temperature Setting. - Check if tubing to Valve V1 and pump P4 are blocked, if necessary replace. - Make sure that pump P6 and valve V1, work properly.

19.12 Problems with Pumps and Valves

Defect Found	Causes and Remedy
Pump P4 does NOT aspirate liquid.	- Pump has worked too long without liquid, magnet is too hot, wait and let it cool off.
Air pump does NOT start.	See chapter 3, 6 and 15. "T.S. Guide".
Pumps P5 – P6 ,do not work	See chapter 4 and 6 "T.S. Guide"
Because the pumps do not work Valves V1 and V2 do not start.	chapter 4 and 10 - "T.S. Guide"
Pump P4 became very noisy. Time to fill the incub. bath has increased. Time to drain the incub. Bath has increase. Incub. bath is not being filled	chapter 16 - "T.S. Guide".

19.13 Leakage Problems

Defect Found	Causes and Remedy
Water residue in cuvettes after wash	- See chapter 16 - "T.S. Guide" - Washing Arm does not work properly, check the aspiration probe if blocked, clean probe internally with a steel wire. - Tubing in pump P5 is damaged or pump broken. - Valve V2 does not work properly , it blocks, check the recycling valve V2 and clean by blowing through it compressed air.
Water inside or under the analyzer.	- Check all pumps and their hydraulic connections - Check Cuvette Washing Arm - Check the Manifold assembly

Leakage from tubing (37) overflow from WASTE container (48) Leakage under the Cuvette Washing Arm Wash solution remains inside the cuvettes. Samples are contaminated Leak in Sampling Arm	See chapter 16 - “T.S. Guide”.
Leakage from tube (37) the over-flow from incubation bath. (66)	- Check the liquid level sensor

19.14 Problems with Printer

Defect Found	Cause and Remedy
Printer does not turn ON.	- Make sure that the power connector is inserted properly - Make sure that the printer is turned ON
Printer is not ON-LINE.	- Make sure printer is set ON - LINEA - Make sure that in Options (F9) the Check Box is set ON – LINE - Make sure that the connection between the printer and analyzer is done correctly.

19.15 Warning Signals, Alarms and Flags

Defect	Cause and Remedy
	The Warning Signals, Alarms or Flags – do NOT stop the analyzer from working, they only advise and register that there is an anomaly during operation, such as: Missing Wash Solution, Missing Reagent, Missing Sample, etc. When the Red Triangle is ON – indicates a flag or a Warning.
WARNING: **Possible alarms present in the System.....** **WARNING:** **Possible alarms in the system.....** **FATAL ERROR**	- Click on the Red Triangle, to open a window that will display the flag or anomaly. To know the reason of the flag, go to Maintenance F8, in section of the flag, there will be a WARNING displayed - The WARNING FATAL ERROR is a warning of danger that will STOP the analyzer. This can be generated from either Hardware or Software, and will not allow the operator to proceed – the analyzer will have to be turned OFF. Should the problem persist when the analyzer is turned ON again, use the Diagnostic Program to find the cause.
WARNING: HARDWARE ERROR - TIME OUT	- This massage blocks the Analyzer. An error generated by the Hardware and will not allow the operator to proceed, the analyzer has to be **turned OFF**. The cause is due to the malfunction of the serial communication of the hardware. - Check the power supply voltage, see chapter 3, the T.S. Guide. - Check the configuration of the serial multi-port - Check the connection of the internal serial port. - Using the Diagnostic Program. Check separately the two sections – Preparation and Measurement in order to determine if the problem is due to the CPU slave or to the multi-serial board.

Operative program signals " FATAL ERROR"....." after giving an intermittent acoustic Beep.	Probable cause: missing signal SYNC from Photometer Module. See chapter 9 "T.S.Guide
Operating Program signals " FATAL ERROR" ....." after giving an intermittent acoustic Beep.	Probable cause: missing signal HOME from Photometer Module See chapter 9 "T.S.Guide"
Operating Program signals " FATAL ERROR" ....." after giving an intermittent acoustic Beep.	Probable cause: Photometer Filter Wheel does NOT turn See chapter 9 "T.S.Guide"
Operative program signals "FATAL ERROR .....", indicating which movement generated the error.	Probable cause: missing the SYNC signal See chapter 11 "T.S.Guide"
Operative program signals "FATAL ERROR .....", indicating which movement generated the error.	Probable cause: difficulty in reading the number of steps of the motor. See chapter 11 "T.S.Guide"
Operative program signals "FATAL ERROR .....", indicating which movement generated the error.	Probable cause: friction in the moving parts. There is NO correspondence between the movement (number of steps) and the number identified by the Encoder. See chapter 11 "T.S.Guide"
Operative program signals "FATAL ERROR .....", indicating which movement generated the error.	Probable cause: problem in communication with the CPU slave on the serial line. See chapter 11 "T.S.Guide"
Operative program signals "FATAL ERROR .....", indicating which movement generated the error.	Probable cause: problem in communication with the CPU slave on the serial line. See chapter 14 "T.S.Guide"
Analyzer turns ON – but does NOT perform the Start up checks. After a few minutes – displays the warning error HARDWARE TIME OUT	See chapter 14 "T.S.Guide"
WARNING signal on temperature	See chapter 6 "T.S.Guide"
NO WARNING flags on: liquid level (INCUB), liquid level (WASH), liquid level (WASTE)	See chapter 11 "T.S.Guide"

20 ACCESSORIES AND SPARE PARTS

Make reference also to the list of spare parts enclosed in each section of this Service Manual.

! When ordering parts, please indicate:
Code Number – Description – Quantity.

20.1 Accessories and General Spare Parts

CODE	DESCRIPTION
A00740.01	Plastic sample Cups (Bag of 2000 p)
KG0046.01	Reagent Bottles – 40ml (box of 50 p)
17905/S	Reagent Bottles 5ml
756.020.040	Rotor pump P 3, P7, P8 tubing included
17995S/20	Adapter for plastic samples cups
MS1204.01	Adapter for bottles 5ml
17915/1	Syringe with piston N° 4
17916/1	Syringe with piston N° 5
17938/S	Sampling and reagent Probe
17920732	Photometer lamp
17950	Optical quartz Cuvette reading (box of 5 p)
17934	Kit Pump tubing for P1, P2, P4, P5 (4 p) + P3, P7, P8 (4 p).
17916/S	Teflon Tubing w/connector for Probe
17995S/1	Fuse (int.) **F5H250V** (Φ 5x20 mm) for 230 Vac
17995S/2	Fuse (int.) **F8H250V** (Φ 5x20 mm) for 115 Vac
17941/11	Water filter for incub. bath
MA0168.01	Sample Tray – Sector A -1÷10
MA0168.02	Sample Tray – Sector B -11÷20
MA0168.03	Sample Tray – Sector C -21÷30
MA0168.04	Sample Tray – Sector D -31÷40
MS1047.02	WASH solution container of 5 L.
A01366.01	Container for incub. liquid. 1 L.
17941	Level sensor electrode for wash solution
AY0038.01	Level sensor electrode for incub. Liquid
KG0054.01	ISE module (complete KIT with Electrodes)
17903/12	Modulo ISE (without Electrodes)
805.004.006	Reference Electrode
805.004.008	Electrode for Na
805.004.007	Electrode for K
805.004.009	Electrode for Cl
805.004.012	Electrode control air bubbles
756.010.041	Pump for CAL A (PA)
756.010.042	Waste pump (PW)
161.035.005	Calibrator A (500 ml)
161.035.016	Calibrator B (125 ml)

161.035.021	Cleaning solution (125 ml)
161.035.022	Diluent for Urine Analysis (125ml)
17907S	Bar Code Reader for Samples (complete KIT)
17908S	Bar Code Reader for Reagents (complete KIT)
AY0121.02	Air pump
680.011.212	Fuse Air pump 1.25A Ø 5x20 mm (230V power supply)
680.010.216	Fuse Air pump 1.6A Ø 5x20 mm (115V power supply)

20.2 Electronic Boards

CODE	DESCRIPTION
EB0043.01	Power supply board
17970/8	CPU slave
17970/31	Level sensor
EA0097.01	Computer PC MASTER (Pentium)
17970/27	Distribution board
17995S/12	Interface pump & valve
17970/10	Power supply lamp
17970/9	Mother board
17970/11	Driver diluter
17970/26	M/B control motor
EB0099.01	M/B control motor
17970/19	ADC converter
EB0033.01	Driver step motor (pump P5)
EB0033.02	Driver step motor (pump P4)
EB0033.03	Driver step motor (pump P1 - P2)
EB0122.01	Driver pump P6
17903/50	Motor Encoder (vertical mov. sampling Probe)
17903/51	Motor Encoder (rotational mov. sampling Arm)
17903/52	Motor Encoder (rotation mov. analytical plate)
17903/53	Motor Encoder)rotation mov. Reagent-samples plate)
A00513.02	Preamplifier
EB0111.01	Bar-code interface
EB0112.01	Signals interface RS232
EA0073.02	Complete microprocessor assy (CPU slave & ADC converter)
910.002.025	Back-plane (passive 6 slot ISA bus)
17987	Serial multiport
930.020.012	Power supply +24V
17970/12	Optical sensor flag HOME (sample plate)
17970/13	Optical sensor flag SYNC (filter wheel)
17970/14	Optical sensor flag HOME (filter wheel)
17970/15	Optical sensor flag HOME (sample arm)

17970/16	Optical sensor flag HOME (reagent arm)
17970/17	Optical sensor flag HOME High (cuvettes washing arm)
17970/18	Optical sensor flag HOME (analytical plate)
17970/20	Driver step motor (reagent & sample arm, analytical & sample plate)
17970/21	Driver step motor (sampling probe – reagent/sample)
17970/22	Driver step motor (filter wheel)
17970/23	Driver step motor (cuvettes washing arm)
17970/25	Driver step motor (reagent plate)
17970/32	Optical sensor flag of HOME (sampling probe)
17995S/10	Optical sensor flag of HOME (reagent plate)
EB0156.01	Optical sensor flag of HOME (sampling arm (new))

20.3 Cable Kit Master Computer (P/N: KG0058.01)

CODE	DESCRIPTION	QTY
910.002.062	HDD cable	1
910.002.063	FDD cable	1
910.002.065	Parallel port cable (printer)	1
910.002.066	Keyboard & mouse cable	1

20.4 Fuses

CODE	DESCRIPTION	QTY
17995S/1	Fuse (switch) **F5H250V** (Φ 5x20 mm) for 230 Vac	2
17995S/2	Fuse (switch) **F8H250V** (Φ 5x20 mm) for 115 Vac	2
680.010.150	Fuse 0,5A (Φ 5x20 mm)	2
680.010.216	Fuse 1,6A (Φ 5x20 mm)	9
680.010.225	Fuse 2,5A (Φ 5x20 mm)	5
17995S/1	Fuse 5A (Φ 5x20 mm)	1
680.015.216	Micro-Fuse 1,6A	3

20.5 Programmable Devices

CODE	DESCRIPTION
PD0011.01	GAL 16V8 - U5 - EB0045.02
PD0012.02	GAL 16V8 – U7 - EB0045.02
PD0052.01	EPROM - U2 - EB0045.02

PD0044.01	Microcontroller PIC - U3 - EB0089.01
PD0053.01	Microcontroller PIC - U1 - EB0072.01 - EB0120.01
PD0041.01	Microcontroller PIC – U3 - EB0046.01
PD0040.01	GAL 16V8 – U1 – U5 EB0046.01
PD0042.01	Microcontroller PIC – U3 - EB0046.01

20.6 General Spare Parts

CODE	DESCRIPTION
EM0050.01	Transformer power supply
EM0052.01	Heating element
17941/2	Temperature sensor
17920/32	Photometer lamp
EA0065.01	Main switch with filter
EA0066.01	Power cord with socket for Air pump & aux
17950	Optical quartz Cuvette reading (box of 5 p)
A00740.01	Plastic sample Cups (Bag of 2000 p)
17915/1	Syringe with piston N° 4
17916/1	Syringe with piston N° 5
17941/3	Level sensor analytical chamber
17938/S	Sampling probe (reagent & sample)
506.120.021	Preamplifier detector

20.7 Interference filters and optical parts

CODE	DESCRIPTION
677.015.005	340 nm
677.015.007	380 nm
677.015.010	405 nm
677.015.020	510 nm
677.015.030	546 nm
677.015.035	578 nm
677.015.040	620 nm
677.015.052	700 nm
674.020.005	Optical lens F=24
17920/30	Complete filter wheel (standard set)
KO0030.01	Set diskettes of blockage (three levels 600, 350, 100)

20.8 Complete Modules

CODE	DESCRIPTION
17956/1	Power supply PC
17915	Dilutor module
AY0096.01	Computer module 1° version
AY0199.01	Computer module 2° version
AY0117.01	Pumps & valves (manifold)
17930	Peristaltic pump P1 – P2
17932	Peristaltic pump P4
17932	Peristaltic P5
17970/30	Complete photometer module
AY0133.01	Complete Bar-code reader (optional)
17903/S	Complete power supply module
AY0131.01	Thermostat
AY0115.01	Refrigeration module
AY0172.01	Cuvettes Washing arm (1° version)
AY0200.01	Cuvettes Washing arm (2 °version)
AY0121.02	Air pump
MC0123.01	Analytical chamber
MA0188.01	Analytical plate

20.9 Connectors and Hydraulic Accessories

CODE	DESCRIPTION	QTÀ
MA0064.01	Syringe holder with Syringe & piston N° 4 (500 µl)	1
MA0064.02	Syringe holder with Syringe & piston N° 5 (1000 µl)	1
17917	Syringe holder	1
17915/1	Syringe with piston N° 4	1
17916/1	Syringe with piston N° 5	1
256.010.009	Rubber ring (O-ring)	1
MS1071.01	Fixing screw for piston (nylon)	1
MS1072.01	Isolating washer (nylon)	1
A01120.01	Connector IN pump P1-P2	2
17953	Connector OUT pump P1-P2	2
A01120.01	Connector IN pump P4	1
A01121.01	Connector OUT pump P4	1
A01121.01	Connector IN-OUT pump P5	1
MS0885.01	Manifold assy AY0117.01	1
MC0128.01	Washing station	1
MC0177.01	Air probe for cuvettes washing arm AY0172.01 e AY0200.01	1
MC0176.01	Wash Probe for cuvette washing arm AY0172.01	1

MC0219.01	Wash Probe for cuvette washing arm AY0200.01	1
17933/3	Rotor for pump P3, P7, P8	1
MC0024.01	Rotor for pump P1,P2,P4,P5	4
17934	Kit Pump tubing for P1, P2, P4, P5 (4 p) + P3, P7, P8 (4 p).	1

20.10 Flat Cables in Movement

CODE	DESCRIPTION	QTÀ
WC0101.02	Level sensor flex cable	1

20.11 FLat cables fixed

CODE	DESCRIPTION	QTÀ
FC0053.01	From J6 - EB0046.01 to J5 - EB0098.01 (W14)	1
FC0053.02	From J7 - EB0046.01 to J4 - EB0098.01 (W15)	1
FC0054.01	From J5 - EB0046.01 to J4 - EB0099.01 (W11)	1
FC0058.01	From J10 - EB0046.01 to J3 - EB0098.01 (W16)	1
FC0059.01	From J8 - EB0046.01 to J5 - EB0099.01 (W12)	1
FC0059.02	From J9 - EB0046.01 to J3 - EB0099.01 (W13)	1
FC0061.01	From J2 - EB0046.01 to J3 - EB0093.01 (W17)	1
FC0061.02	From J4 - EB0046.01 to J1 - EB0093.01 (W18)	1
FC0061.03	From J3 - EB0046.01 to J5 - EB0093.01 (W19)	1
FC0066.02	From J7 - EB0093.01 to J1 - EB0068.01-D2 (W20)	1
FC0066.01	From J8 - EB0093.01 to J1 - EB0068.01-D1 (W21)	1
FC0049.01	From J13 - EB0093.01 to J1 - EB0033.01-P2 (W24)	1
FC0049.02	From J15 - EB0093.01 to J1 - EB0033.01-P5 (W25)	1
FC0062.01	From J12 - EB0046.01 to J1 - EB0043.01-P5 (W10)	1
FC0067.01	From J9 - EB0093.01 to J1 - EB0033.01-P1 (W22)	1
FC0067.02	From J10 - EB0093.01 to J1 - EB0033.01-P4 (W23)	1

20.12 Calbes unipolar

CODE	DESCRIPTION	QTA
EA0066.01	Power cord with socket for Air pump & Aux	2
WC0066.01	From J2 – EB0043.01 to P2 – 930.020.012 Power supply cable +24 V	1
WC0067.01	From J5 – EB0101.01 to P1 – 930.020.012 Power supply cable 230 Vac	1

WC0068.01	From J9 - EB0043.01 to J8 - EB0101.01 Signal cable for Air pump	1
WC0082.01	From J16 - EB0046.01 to P1 – MC0163.01	1
WC0084.01	From J24 - EB0046.01 to J12 - EB0043.01	1
WC0085.01	From J10 - EB0043.01 to P1 – Refrigeration system	1
WC0086.01	From J6 - EB0093.01 to J7 – EB0043.01 – J2 – EB0098.01 – J1 EB0099.01	1
WC0087.01	From J2 - EB0093.01 to J8 – EB0043.01 – J1 – EB0098.01	1
WC0089.01	From J12 - EB0093.01 to P3, D2, P2	1
WC0091.01	From J11 - EB0093.01 to P8, D1, P1	1
WC0090.01	From J10 - EB0093.01 to P6, V4, V5, P5, P7	1
WC0092.01	From J5 - EB0043.01 to J1 – EB0054.01	1
WC0095.01	From J4 - EB0093.01 to J6 – EB0043.01 – J2 – EB0099.01	1
WC0098.01	From J11 - EB0043.01 to J6 – EB0046.01 – AY0131.01	1
WC0105.01	From J4-5 AY0097.04 – J1 EB0046.01 – P8-9 connector back plane (power supply master PC)	1
910.004.004	Power supply for CD-ROM driver (optional)	1

20.13 Motors

CODE	DESCRIPTION	QTY
EM0011.01	Dilutor motor	2
EM0023.01	Peristaltic pump motor P4 – P5	2
EM0025.01	Peristaltic pump motor P1 - P2	2
EM0028.01	Sampling arm motor (rotational)	1
17995S/7	Reagent plate motor (rotation)	1
17995S/8	Reagent arm motor (rotational)	1
17995S/4	Analytical plate motor (rotation)	1
EM0036.01	Filter wheel motor (rotation)	1
EM0038.01	Mixer motor	2
17995S/6	Sample plate motor	1
17995S/5	Sampling probe motor (reagent/sample)	2
17937	Peristaltic pump motor P3 – P7 – P8	3
EM0050.01	Transformer power supply	1
EM0144.01	Cuvettes Washing arm motor	1
17940	Electro-valves V1- V2	1
EM0052.01	Heating element for thermostat	1
756.030.010	Linear pump (P6)	1

20.14 Encorder Assemblies

CODE	DESCRIPTION	QTY
AY0104.04	Complete motor + Encoder analytical plate (reading)	1
17925	Complete motor + Encoder reagent and sample probe	2
AY0163.01	Complete motor + Encoder sample plate (rotation)	1
AY0164.01	Complete motor + Encoder reagent plate (rotation)	1
AY0168.01	Complete motor + Encoder reagent arm (rotational movement)	1
AY0169.01	Complete motor + Encoder sample arm (rotational movement)	1

20.15 BELTS

CODE	DESCRIPTION	QTY
218.152.060	Sampling probe	2
218.152.068	Dilutor	2
218.152.092	Filter wheel	1
218.152.110	Sampling arm (rotational movement)	2
218.152.110	Analytical plate 1° (small pulley)	1
218.152.248	Analytical plate 2° (big pulley)	1
218.152.310	Sample plate	1
218.152.280	Reagent plate 1° (big pulley)	1
218.152.088	Reagent plate 1° (small pulley)	1

20.16 Service Kit (P/N:KG0065.01)

CODE	DESCRIPTION	QTY
910.002.031	Serial multiport board	1
930.020.012	Power supply board +24V	1
A00752.01	Pump tubing P1 - P2 - P4 - P5	10
756.020.040	Rotor pump P3 - P7 - P8	4
A00852.01	Syringe with piston N° 4	1
A00853.01	Syringe with piston N° 5	1
AY0041.02	Preamplifier with detector	1
AY0109.01	Peristaltic pump assy P1 – P2	1
EA0053.01	Fan for refrigeration system	1
EA0065.01	Main switch with filter	1
EA0067.02	Power supply PC	1
EA0072.01	Peltier devices for refrigeration system	1

17920/32	Photometer lamp	5
17970/31	Level sensor board (sampling probe)	1
EB0033.01	Driver step motor for peristaltic pump	1
EB0043.01	Power supply board	1
17970/12	Optical sensor flag HOME cuvettes washing arm	1
17970/20	Driver step motor	2
17970/21	Driver step motor	2
17970/22	Driver step motor	1
17970/23	Driver step motor	1
17970/25	Driver step motor	1
EM0038.01	Mixer motor	1
17915/2	Rubber ring (O-ring) for syringe N°4 and N°5	1
17950	Optical quartz Cuvette reading (box of 5 p)	1
17938/S	Sampling probe (reagent & sample)	2
17916/S	Sampling probe tubing	4
910.001.032	Hard disk without program	1

20.17 Bar Code Reader Assembly (P/N:AY0133.01)

CODE	DESCRIPTION	QTY
230.311.206	Screw TCC M3x6 inox	2
230.313.104	Screw TCC M2x4	3
276.012.012	Fix cable	2
330.020.110	Jumper	1
506.200.005	Driver bar-code	1
506.200.090	Flex cable	1
EB0111.01	Interface Bar-code	1
MS1063.01	Bar code holder in PVC	1

20.18 KIT Bar Code Reader Samples (P/N: KG0055.02)

CODE	DESCRIPTION	QTY
AY0133.01	Samples Bar-code reader assembly	1
FC0068.01	Flat cable 20 pin	1
FC0086.01	Flat cable 10 pin	1
MS1074.01	Spacer	1
EB0112.01	Signals interface RS232	1

20.19 KIT Bar Code Reader Reagents (P/N: KG0055.03)

CODE	DESCRIPTION	QTY
AY0133.01	Reagents Bar-code reader assembly	1
FC0068.01	Flat cable 20 pin	1
FC0086.01	Flat cable 10 pin	1
MS1074.01	Spacer	1
EB0112.01	Signals interface RS232	1
MS1002.01	Mirror	1

20.20 KIT Bar C. Reader Reag-Sample (P/N: KG0056.01)

CODE	DESCRIPTION	QTY
AY0133.01	Bar-code reader assembly (reagent and sample)	2
FC0068.01	Flat cable 20 pin	1
FC0086.01	Flat cable 10 pin	1
MS1074.01	Spacer	1
EB0112.01	Signals interface RS232	1
MS1002.01	Mirror	1

20.21 ISE Module (P/N: KG0019.01)

CODE	DESCRIPTION	QTY
166.050.050	Adhesive tape to fix power supply L=90mm	1
230.311.206	Screw TCC M3x6 inox	3
230.311.208	Screw TCC M3x8 inox	2
230.311.260	Screw TCC M4x12 inox	2
230.341.209	Screw TPSC M3x10 inox	4
231.101.203	Nut M3 inox	4
232.151.201	Indented washer for M3 inox	6
17941	Level sensor cup for CAL- A	1
MS0882.01	Module holder	1
MS1008.01	Pump holder	1
MS1046.01	Container 250 mL	1
TU0074.01	Connecting tubing waste container	2
TU0077.01	Aspiration tubing CAL - A	1
AY0136.01	Assembly drawing ISE module	1
308.010.034	Power supply cable	1
310.009.009	Serial cable	1
379.005.009	Serial adapter	1

930.020.014	Power supply	1
805.004.012	Electrode control air bubbles (only on request)	1
161.035.004	Calibrator A 250 ml	1
161.035.016	Calibrator B 125 ml	1
161.035.021	Cleaning solution 125 ml	1
756.010.041	Calibrant A pump (with tubing)	1
756.010.042	Waste pump (with tubing)	1
17903/12	ISE module (without electrodes)	1
805.004.006	Reference electrode	1
805.004.007	Electrode K	1
805.004.008	Electrode Na	1
805.004.009	Electrode CI	1
17903/10	Pump connecting cable	1
805.004.012	Electrode control air bubbles (only on request)	1
MS1438.01	Tubing connection	1
TU0045.02	ISE waste tubing	1
TU0098.02	Join tubing for ISE	1

20.22 Devices for Maintenance (P/N: KG0070.01)

CODE	REF.	DESCRITION	QTY
MS1126.01	D/1	Cuvette extractor	1
MS1127.01	D/2	Device to center the washing probe into the cuvettes	1
MS1129.01	D/3	Spacer of 2 mm to HOME sampling probe	1
MS1131.01	D/5	Probe to align sampling arm	1
MS1132.01	D/6	Device to align analytical plate	1
MC0161.01	D/7	Probe declogger	1
MS1133.01	D/8	Alignment SYNC of encoder disk	1
MS1135.01	D/9	Spacer to adjust the cuvettes washing arm	1
MS1130.01	D/10	Spacer to adjust HOME diluter	1
MC0162.01	D/11	Friction device for pulley to align the analytical plate (with spring)	1
MC0169.01	D/12	Device to align SYNC of encoder disk	1
MS0314.01	D/28	Interference filter extractor	1

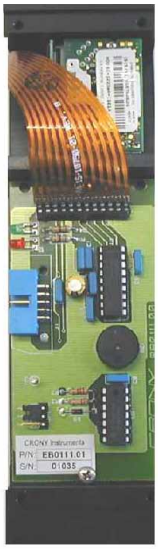
21 OPTIONAL MODULES

This Chapter describes Optional Modules installation. However, installation should be done at the factory or by specialized Crony personnel.

21.1 Bar Code Reader

TECHNICAL DESCRIPTION:

The Bar Code Reader Module is identified with P/N: AY0133.01 (see image on the right).

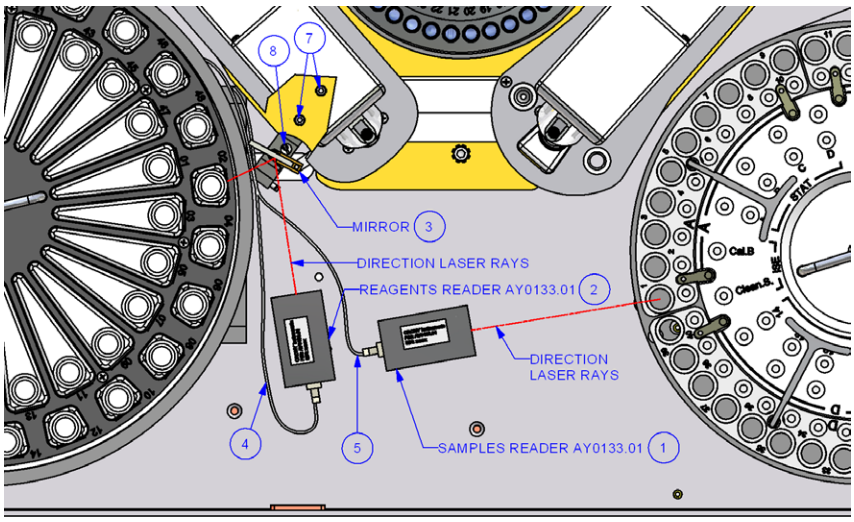


The Module consists of:

- Interface Board
- Driver Reader
- Flat Cable Interconnection
- PVC Support

The Reader is enabled for the following code:

- Code 128



21.1.1 BAR CODE READER INTERFACE (P/N: EB0111.01)

TECHNICAL DESCRIPTION

- Converts TTL/CMOS reader signals into standard RS-232 signals.
- The Reader is set by means of jumper JP1.

FIGURE 76
Visible Signals

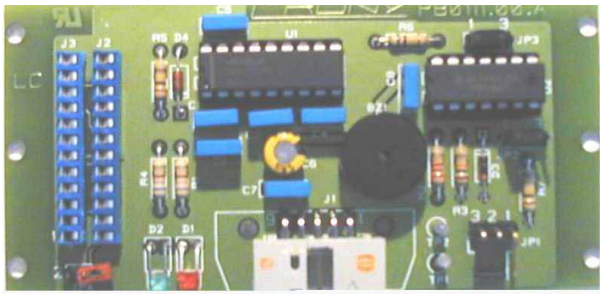


TABLE 21
Visible Signals

D1 (Red)	Power supply +5V
D2 (Green)	Reading OK

TABLE 22
Jumpers Position

JP1	1-2 Samples / 2-3 Reagents (see note below)
JP2	1-2
JP3	1-2
JP4	Open

! In this application both bar-code readers (reagent & sample) are set via JP1 (1-2)

DOCUMENTATION

EB0111.01.A.SC – Bar code interface - Electrical diagram, see section 19.2-1
EB0111.01.A.PM – Bar code interface – Assembly drawing, see section 19.2-2

21.1.2 ASSEMBLY PROCEDURE AND MAINTENANCE

Remove the top panels of the Analyzer. (See Chapter 16 “General Maintenance” Section “Removing the outside panels“)

WARNING ! SAFETY WARNING ⚠

! Procedure to be carried out with Analyzer turned OFF.

The BAR_CODE READER uses a laser system. **Do Not Look directly into the beam.**

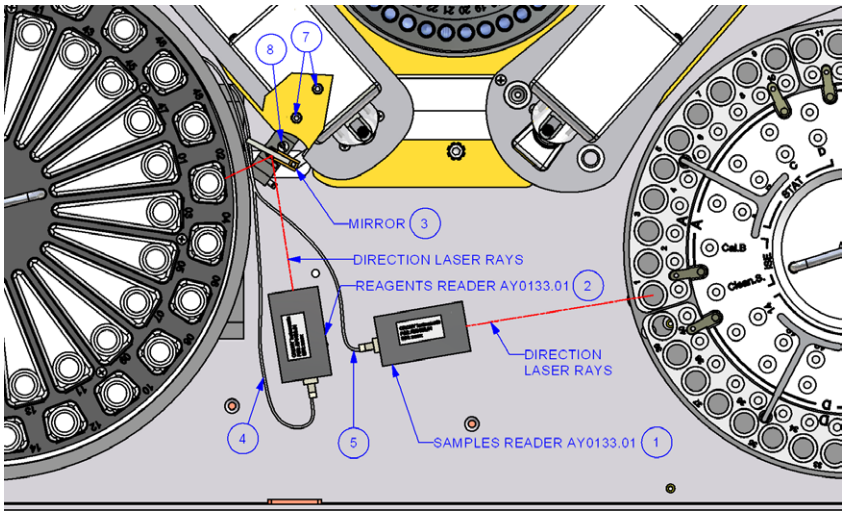


FIGURE 77
Reagents and Samples Bar Code Readers

REAGENTS BAR CODE READER („Figure 77“)

1. Mount the Reader (2) on the Analyzer base; fix it with the screws from underneath the analyzer base without tightening them (use 4mm hex key), to allow for later re-aligning of the Reader, if necessary.
2. Position the mirror assembly mechanism (8) „Figure 77“ and fix it either to the measurement system base or to the (PVC) reagent support, depending on the version, and tighten the two screws.
3. Connect the new 10 pin flat cable (4) (P/N: FC0086.02) to J2 on the EB0175.01 board (mounted on the Microprocessor mother board EB0180.01) and to J1 on the EB0111.01 board of the Reagent Bar Code Reader (2) AY0133.01 (see „Figure 77“).

SAMPLES BAR CODE READER („Figure 77“)

4. Position the Bar-code Reader(1) on the analyzer base and fix it with the two screws from underneath the base without tightening them (use 4mm hex key), to allow for later re-aligning of the Reader, if necessary.
5. Connect the second 10 pin flat cable (5) (P/N: FC0086.03) to J1 on the EB0175.01 board (mounted on the Microprocessor mother board EB0180.01) and to J1 on the EB0111.01 board of the Sample Bar Code Reader (1) AY0133.01 (See „Figure 77“).

! **Procedure to be carried out with the Analyzer turned ON and Tester program loaded**

21.1.3 BAR CODE READER OPTICAL ALIGNMENT

1. Click in sequence **[PWR ON], [HOME Z]**, and **[HOME PLATE]** of both the Reagent and the Sample Systems.

REAGENTS CHECK PROCEDURE

Make sure that the Reagent Bottle has a legible label with the correct Bar Code in front (see picture on the side). Insert the bottle in position 1 Int. of the Reagent Plate. Be sure that the label:

- Is not damaged and readable
- Is not larger than the reagent plate window.
- Has a valid barcode (see „21.1 Bar Code Reader“)

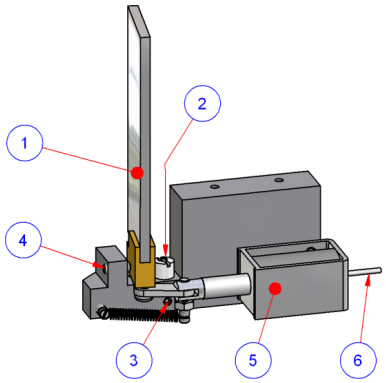
2. Click on **[BarCode]** of the Reagent system. The mirror **CHECK BOX** ☑must be disabled (See image on the side). The Bar Code number will be displayed in the Bar Code field, as shown in the image on the side.

3. Click on **[Init]** and wait for the beeps that signal the reader **INIT**.
4. Center the bar-code assembly (2) by moving it a little (5mm) to the left or to the right.
5. Click on **[Scan]**, and adjust the mirror (1) „Figure 78“ with the hex screw (4) (use a 1.5mm hex key), until the Laser beam hits exactly the middle

6. of the Bar Code Label of bottle 1 (see image on the right and „Figure 79“), if necessary move slightly the Reader Assembly (2) „Figure 77“.

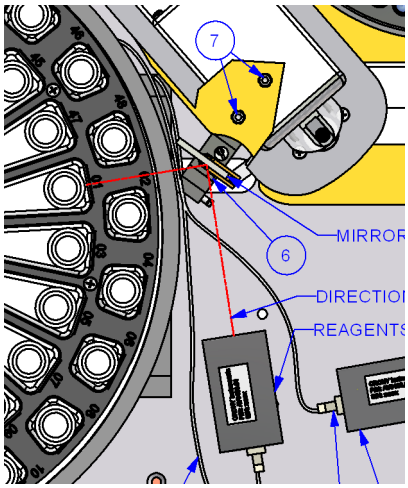
7. Repeat reading by pressing **[Scan]** button to make sure it is correct.
8. On the box window of Test will be displayed the correspondent number of the Bar code label, and an acoustic beep confirms the right reading.
9. **[Move]** the reagent Tray in the position of bottle 2.
10. To activate the magnet that moves the mirror, clicking on the **CHECK BOX** ☑ mirror (See image below).

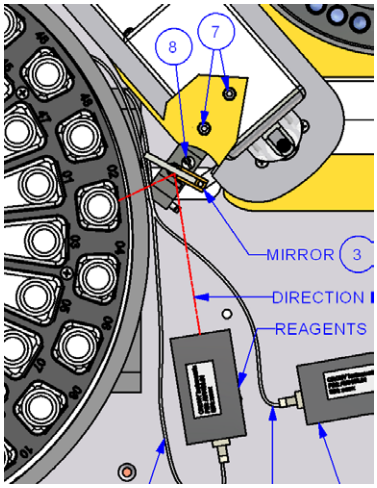
FIGURE 78



11. Click on **[Init]** and wait some acoustic beeps that signalize the INIT of reader.
12. Click on **[Scan]** button, and check if the Laser beam hits exactly in the middle the Bar Code Label of bottle 2, (see image on the right) „Figure 80“. If necessary adjust the cams (2) (use the flat screw driver 5mm) „Figure 78“ to obtain the its correct reading.

FIGURE 79
FIGURE 80





13. Repeat reading by pressing **[Scan]** button to make sure it is correct.
14. On the box window of Test will be displayed the correspondent number of the Bar code label, and an acoustic beep confirms the right reading.
15. Once found the right position, tighten the screws below the assay bar code reader (2) (use hex key 4mm) and hold the cams (2) by screw (3) „Figure 78“ (use hex key 1,5mm).
16. It is suggest after all the adjustments, make a complete check of the reagent positions by the Diagnostic tester.
17. In case of a wrong or missing reading, the display will show the message “**NR**“ (NO reading).
18. Click on the gray colored area to close the test.

PROCEDURE TO CHECK SAMPLES ON THE PRIMARY TUBE

Make sure that the Sample tube has a legible Bar Code Label positioned vertically in the middle of the test-tube (see on the side).

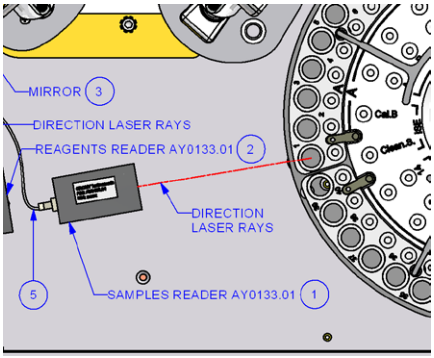
Insert the test-tube into position 38 on the Sample Tray.

Be sure that label has:

- Be whole and readable
- Be an active code (see „21.1 Bar Code Reader“)

19. Click on **[BarCode]** in the area Sample. The Bar Code Test will be displayed on the monitor, as shown on side.

20. Click on **[Init]** and wait some acoustic beeps that signalize the INIT of reader.
21. Click on **[Scan]** and observe the direction of the Laser beam, it should hit the Label exactly in the middle, repeat the test, if necessary rotate the assay Reader (1) to align it and check again the reading. See image on side.



22. Tighten the screws (use a hex key 3 and 4mm) and repeat the reading more times.
23. In case of a wrong or missing reading, the message "**NR**" (NO reading). Its will be displayed.
24. Click on any gray area to close the program.

When finished the testing procedure, verify again the Bar Code Readings of both the Sample and Reagent.

21.1.3.1 Replace the Bar Code Driver Board

Operation to be done with Analyzer turned OFF.

Remove the top panels (see General Maintenance).

1. Remove the screws holding the Bar Code assembly.

! The flex cable P/N: 506.200.090 has the electrical contacts on one side only. DO NOT INVERT THE FLAT CABLE .

2. Replace the board (in case of two connectors J2 and J3, make sure to respect the position of the flex cable to connector **J2 EB0111.01**.
3. Proceed to check the operation as described in „21.1.3 Bar Code Reader Optical Alignment“.

21.1.3.2 Replace the Reader driver

! Operation to be done with Analyzer turned OFF.

! The flex cable P/N: 506.200.090 has the electrical contacts on one side only. DO NOT INVERT THE FLAT CABLE.

Remove the top panels (see Section “General Maintenance“).

1. Remove the screws holding the Bar Code assembly.
2. Disconnect the flex cable of the Reader driver from board EB0111.01 and replace the Reader.
3. Proceed to check the operation as described in „21.1.3 Bar Code Reader Optical Alignment“.

21.1.3.3 Magnet (5) of the Mirror assay replacement

! Operation to be done with Analyzer turned OFF.

Remove the top panels (see Section “General Maintenance“).

1. Remove the screws (7) holding the complete Mirror assay (see „Figure 81“).
2. Disconnect the Magnet connector from the RS232 interface & µC supervisor board code N° EB0175.01
3. Remove two lateral screws that holding the Magnet (5) to its holder (see „Figure 82“).
4. Take off the Magnet (5) and replace, code N° EM0027.01
5. Reassemble in reverse way.

FIGURE 81

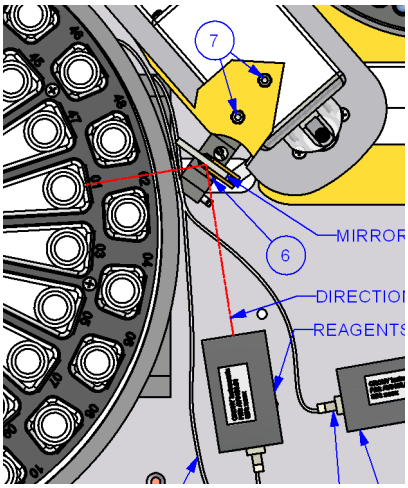
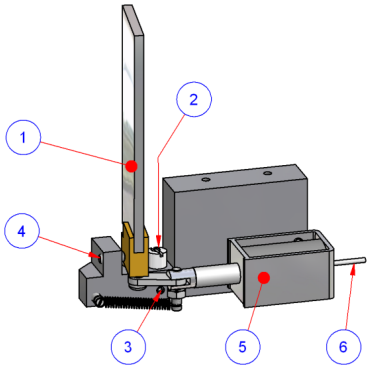


FIGURE 82



21.1.4 TROUBLE SHOOTING GUIDE

To solve some of the problems it will be necessary to use the Diagnostic Program.

Defect Found	Causes and Remedy
Bar Code Reader does NOT work. (no acoustic beeps)	1. Check connection of flat cable FC0086.02/3 between the EB0175.01 board and bar code interface EB0111.01. 2. Check the correct jumper JP1 on EB0111.01 3. Make sure that the red LED on board EB0111.01 is ON, if necessary replace the fuse F1 (2.5A) on the EB0180.01 board 4. Check voltage +5V on TP1 EB0111.01 5. Replace board EB0111.01 6. Replace the Reader driver 506.200.005
Bar Code Reader does NOT work. (there is NO Laser beam)	1. Check as above
Bar Code Reader does NOT read always correctly	1. Check if the cause is due to the Label. Use a reference Label. 2. If the problem persists, check alignment of the Laser beam. (See „21.1.3 Bar Code Reader Optical Alignment“)
The magnet that moves the mirror does not work	1. Check voltage +12V on the EB0180.01 board by led DL1 is ON. 2. Make sure that the yellow LED DL2 on board EB0175.01 is ON with check box enabled 3. Check connection between J8 of EB0175.01 and the magnet. 4. Check the efficiency of the mechanism of mirror by checking if it has too friction. 5. Check the continuity of the magnet coil EM0027.01 by measuring the its resistance of about 50 Ohm, if necessary replace it. 6. Replace board EB0175.01.

! **Crony Instruments suggests to keep in stock the parts indicated with (•).When ordering parts make sure to mention: Code Number and Description.**

21.1.5 SPARE PART LIST

P/N	DESCRIPTION	QTY
KG0114.03	**Kit Bar Code Reader Samples**	**1**
AY0133.01	Bar-code reader assembly	1
FC0086.03	Flat cable 10 pin	1
230.101.259	Screw TCEI M4x10	2
232.101.251	Washer flat M4	2
KG0114.04	**Kit Bar Code Reader Reagents**	**1**
AY0133.01	Bar-code reader assembly	1
FC0086.02	Flat cable 10 pin	1
MA0230.01	Mirror + magnet assay	1
230.101.259	Screw TCEI M4x10	2
232.101.251	Washer flat M4	2
230.101.209	Screw TCEI M3x10	2
232.153.201	Washer M3	2
KG0115.02	**Kit Bar Code Reader Reagents and Samples**	**1**
AY0133.01	Bar-code reader assembly	2
FC0086.02	Flat cable 10 pin	1
FC0086.03	Flat cable 10 pin	1
MA0230.01	Mirror + magnet assay	1
230.101.259	Screw TCEI M4x10	4
232.101.251	Washer flat M4	4
230.101.209	Screw TCEI M3x10	2
232.153.201	Washer M3	2
AY0133.01	**Bar-code reader assembly**	**1**
230.311.206	Screw TCC M3x6	2
230.313.104	Screw TCC M2x4	3
276.012.012	Fix cable	2
330.020.110	Jumper	1
506.200.005	Driver bar-code	1
506.200.090	Flex cable	1
EB0111.01	Interface Bar-code	1
MS1063.01	Bar code holder in PVC	1
MA0230.01	**Mirror & magnet assay**	**1**
EM0027.01	Magnet	1
MA0226.01	Mirror	1

21.2 Documentation

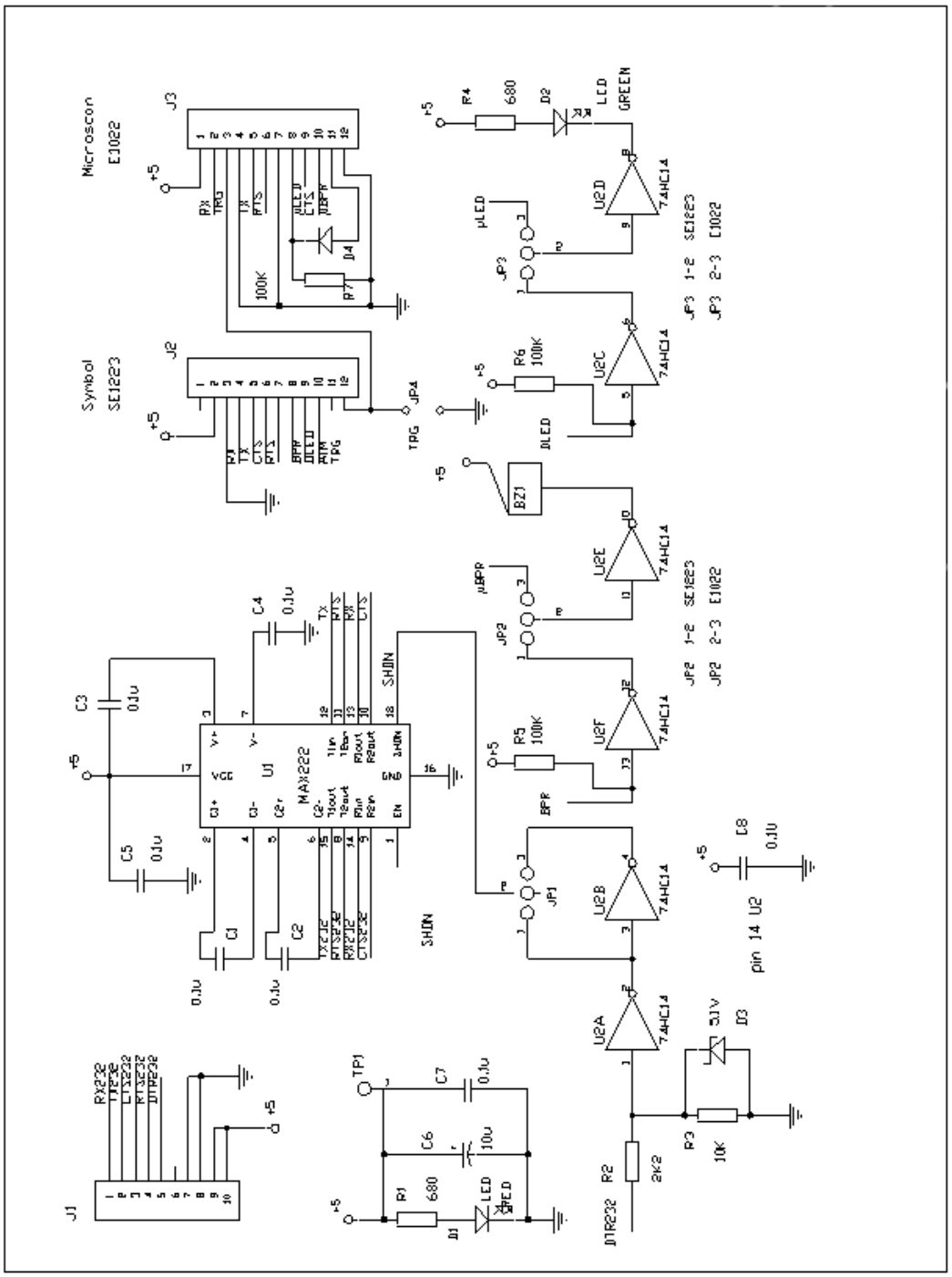
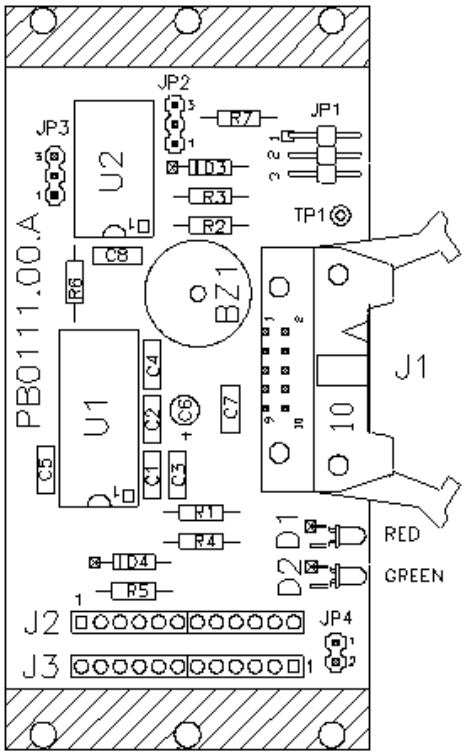


FIGURE 83

FIGURE 84


JP2
JP3
JP1
R7
D3
R3
R2
TP1
U2
C8
R6
BZ1
PB0111.00.A
U1
C4
C2
C6
C7
C5
C1
C3
J1
10
R1
R4
D4
R5
D1
RED
D2
GREEN
J2
JP4
J3

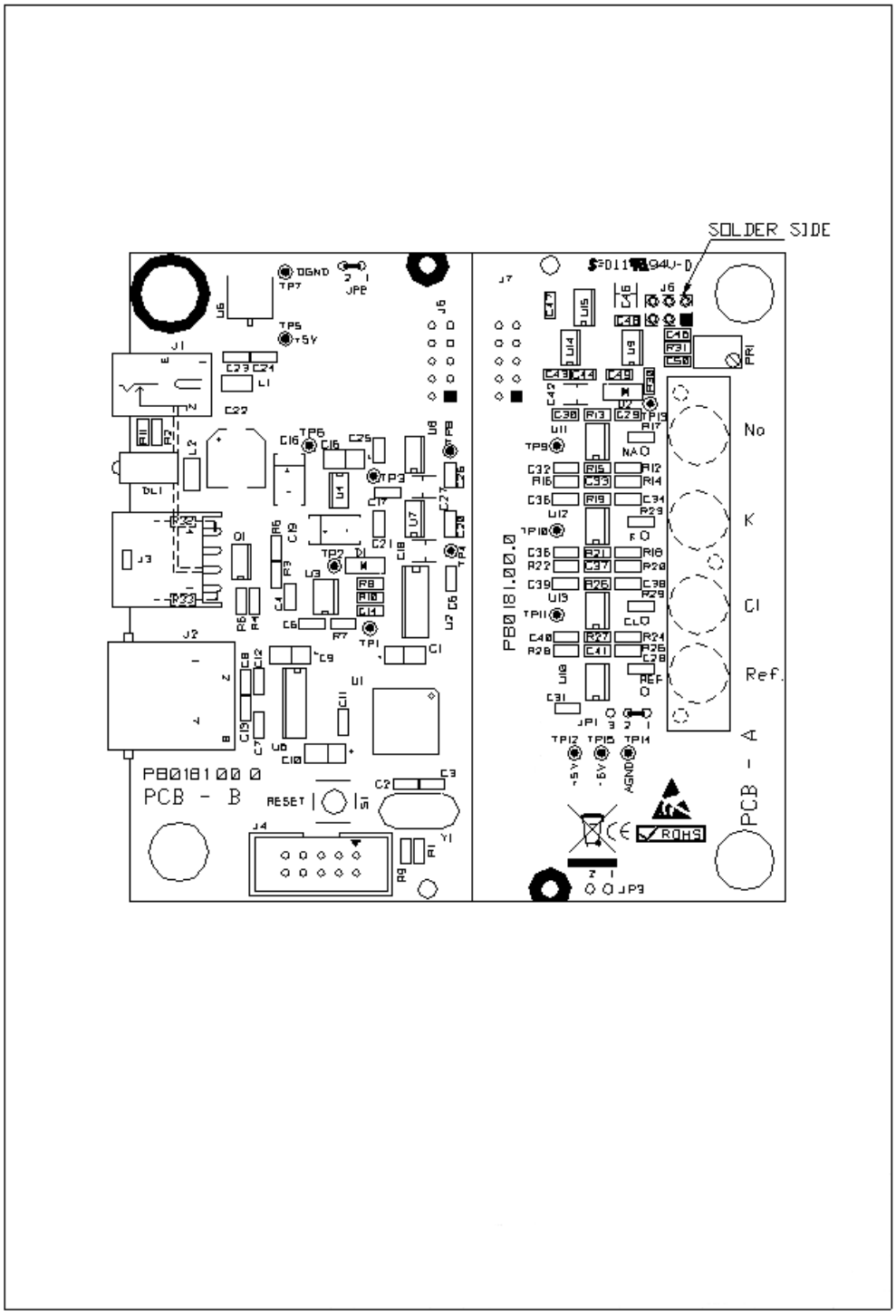
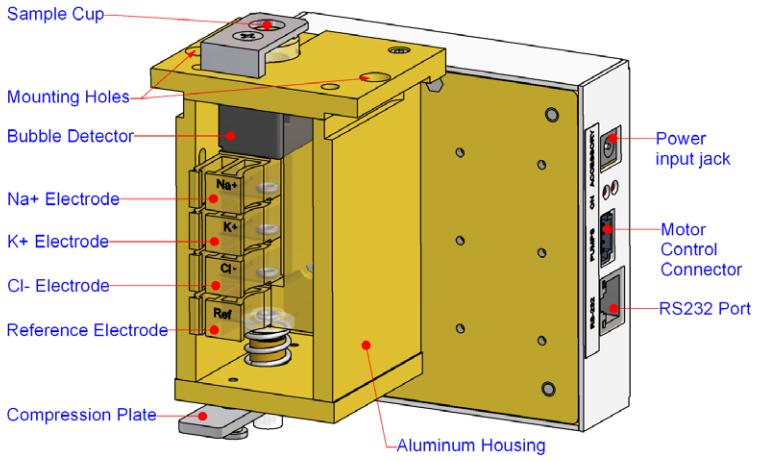


FIGURE 85

21.3 ISE Module (P/N: KG0019.04)

21.3.1 INTRODUCTION

The ISE Module is an optional accessory built-in the HumaStar HS300SR analyzer, for the automatic determination of electrolytes. It's a compact, precise and reliable modular accessory that compliments the system by increasing considerably the throughput without complicating its operation.



The ISE module is easily built-in into the HumaStar HS300SR, for the automatic determination of Na, K and Cl in Serum, Plasma or diluted Urine.

The ISE Module can be installed in the factory or by a qualified Crony service engineer in the customers Lab.

The module is self-sufficient, all operations are automatic, and all operation, data transfer and exchange are controlled by the Analyzer through a dedicated serial line.

The ISE Module requires only a single Reagent – Calibrator A - which is both one of the calibrators as well as regenerates the electrodes. A second Calibrator B is used as a second Standard and is located on the Sample tray together with all the other Standards and Calibrators.

During the operative cycle, the Sampling probe transfers 90 µl of sample directly into the Module. After each measurement there is an automatic wash with Calibrator A to avoid contamination and the carry-over from sample to sample (carryover).The Module holds four electrodes for Na, K, Cl and a Reference.

21.3.2 SOME HIGHLIGHTS AND SPECIFICATIONS

Characteristics	Benefits
Integral sample entry port	Minimizes sample carryover
Small Sample size	Only 90 µl
Electrodes mounted close to electronics	Minimum electronic noise, improves precision.
Rapid operation (only 30 sec. cycle time)	Fast results for all 3 determinations
No membranes to be serviced	Simple maintenance
Easy access to pumps	Maintenance done by lab personnel
Two point calibration	High accuracy and precision
One point calibration with every sample	High accuracy and precision
Maintenance free electrodes	Convenient and less maintenance

SOME TECHNICAL SPECIFICATIONS

Sample :	Serum, Plasma, or Urine (Urine requires dilution)
Sample Volume :	Serum or plasma 90 µl – (3 channel. Na, K, CL) Diluted urine 160 µl
Reproducibility:	Maximum imprecision (within run) Serum, Typical CarryOver % (in serum) Na CV <1.5% (100-160 Mmol/L) <0.5% K CV <2% (3.00-6.00 Mmol/L) 1.5% Cl CV <2% (80.0-120.0 Mmol/L) <1.0%
Analysis Time :	serum or plasma - 60 seconds, (including one point calibration) Urine – 60 seconds, (including one point calibration)
Throughput:	(60 x 3 parameters) 180 tests per hour.
Power Supply:	12VDC - 0.6A
Reagents:	Calibrator A, Calibrator B, Cleaning Solution, Urine Diluent
Maximum Ambient Temperature:	+ 38°C

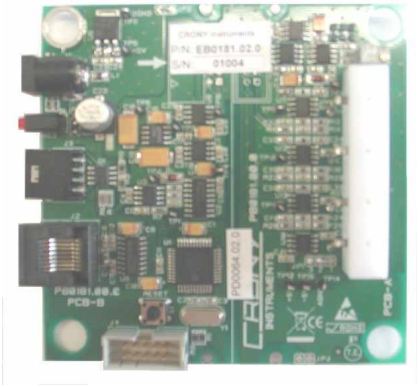
! Adjust the voltage on TP13, every time the bubbles detector has to be replaced (see the procedure below)

21.3.3 ISE CONTROL BOARD (P/N: EB0181.02)

TECHNICAL DESCRIPTION

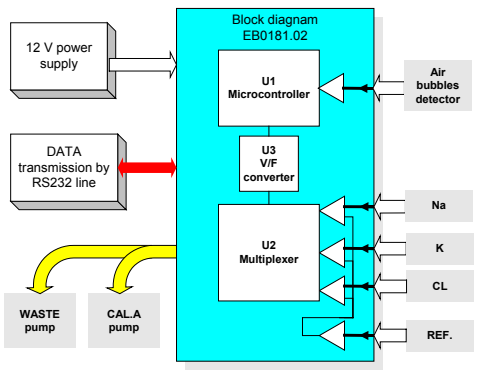
This board receives the signals from four electrodes Na, K, CL and Ref, and by means the three pre-amplifiers converts these signals in an output continuous voltage.

The analogical signals from pre-amplifiers are sent to a multiplexer and later to a voltage frequency converter V/F. This latter, generates in out a square signal with frequency proportional to its input voltage and with an amplitude of about 5V. The frequency comes sent to an input of µ-controller to be measured. A second input of µ-controller, receives the signal from an air bubbles detector for determine the proper filling of electrodes. The structure of this board is shown in the block diagram below.



The µ-controller controls two peristaltic pumps;

- **Waste** Pump (AY0238.01) transfers the solution's (Cal.A or sample) from the inlet cup to the electrodes channel and after each sample empties the liquid from same channel to waste well.
- **Cal.A** Pump (AY0238.02) transfers the Calibrator A toward the inlet cup of the ISE module.



„Table 23“ shows the voltage values of the stepper motors and the „Table 24“ the position of the jumpers present on the board.

Item	Test point	Range
1	TP1	Frequency amplitude from + 0V to + 5,25V
2	TP2	Output of electrodes from 0,5V to 3V
3	TP3	from +11,0V to +12,5V
4	TP4	from + 4,75V to + 5,25V
5	TP5	from + 4,75V to + 5,25V
6	TP6	AGND
7	TP7	DGND
8	TP8	from – 4,75V to - 5,25V
9	TP9	Output Na electrodes from 0,5V to 3V
10	TP10	Output K electrodes from 0,5V to 3V
11	TP11	Output CL electrodes from 0,5V to 3V
12	TP12	From + 4,75V to + 5,25V
13	TP13	From + 0,7V to + 4V Reg. PR1
14	TP14	AGND
15	TP15	From - 4,75V to - 5,25V

TABLE 23

All voltages are referred to AGND = DGND = TP6 = TP7 (with JP2 closed)

JP1	1-2
JP2	closed
JP2	open

TABLE 24
Jumpers Settings

Board	Description	Device	Layout Ref.	Firmware P/N
EB0181.02	ISE control board	PIC30F4011	U1	PD0064.02

TABLE 25
List of programmable devices

DOCUMENTATION

EB0181.02.0.SC - ISE module control board, Electrical diagram, pg 1-2, see „Figure 83“.

EB0181.02.0.SC - ISE module control board, Electrical diagram, pg 2-2, see „Figure 84“.

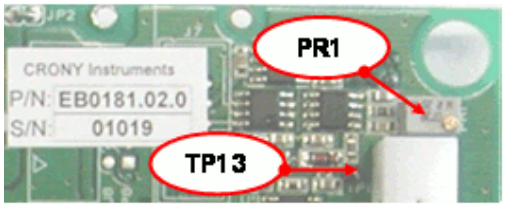
EB0181.02.0.PM - ISE module control board, Assembly drawing, pg 1-2, see „Figure 85“.

21.3.3.1 How changes the air bubble signal (TP13) during a purge cycle

The air bubble flag (TP13) informs the micro-controller about the proper filling of electrodes channel, it is generated by an optical detector.

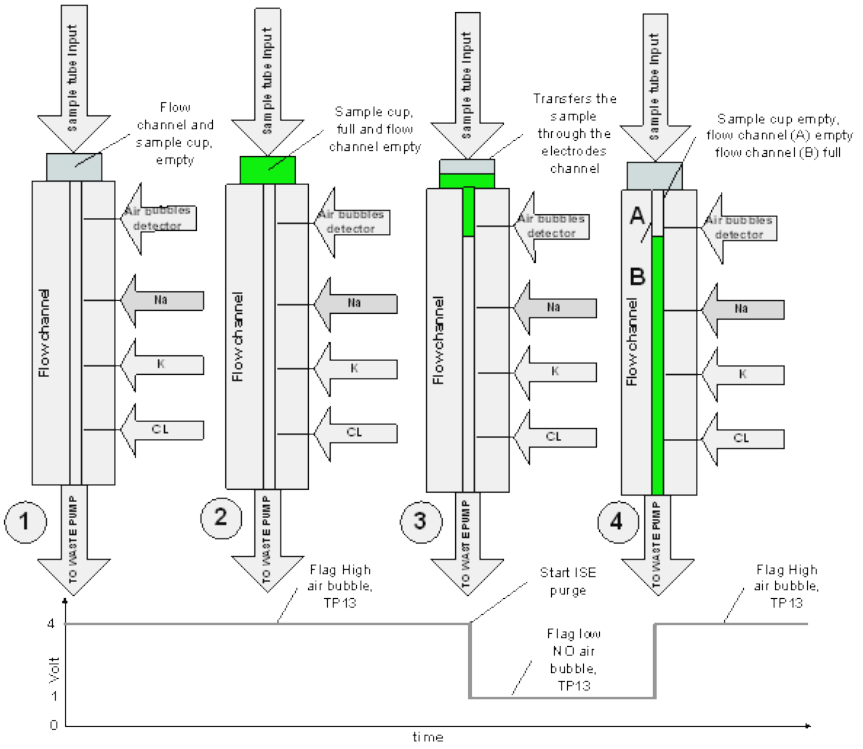
The diagram below shows the four phases of purge cycle:

1. The electrodes channel and also the input sample cup are both empties, TP13 is low about > 4V.
2. In this phase the sample cup is full while the electrodes channel is empty (WASTE pump OFF).



3. Start the ISE purge command, start the WASTE pump, the sample comes transferred into the electrodes channel and the detector signal changes from about 4V to < 1V.
4. During this time the electrodes channel comes filled with solution and only when the signal of detector changes again to about 4 V, the waste pump is deactivate. In this way the sector (A) of electrodes channel is empty, while the next sector (B) is completely filled.

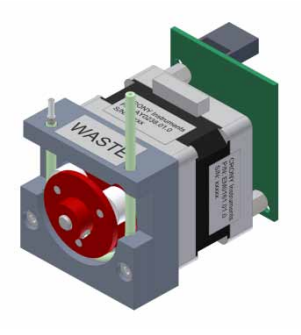
The flag output signal TP13 is adjusted by PR1, when the electrodes channel is completely empty; its value is set about 4V.



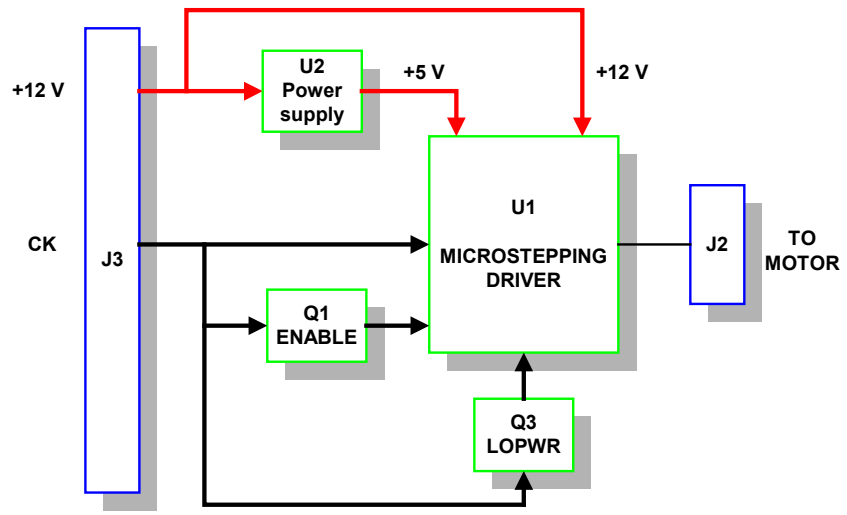
21.3.4 PERISTALTIC PUMP DRIVE (P7N. EB0161:05-06)

TECHNICAL DESCRIPTION

- To drive the motor
- To enable the motor to turn
- To vary speed of the motor
- To break off the power during standby operation
- To protect the Input line of +12V, by means of fuse F1, against current over-load

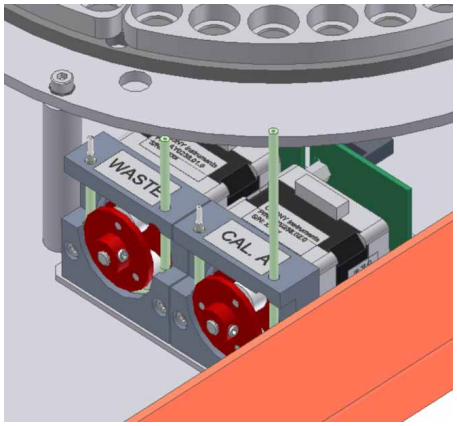


Block diagram EB0161.XX



HARDWARE CONFIGURATION

Table 19.3-3 shows the voltage values of the stepper motors and Jumpers settings on the board. **DO NOT change the Jumpers settings.**
The figure on the right shows the disposition of the pumps inside the analyzer. Do NOT change the positions of these pumps, avoiding malfunctions.
Changing a pump or its PCB, make sure that spare part has exactly the same identification number indicated on the board or on pump assembly.



DOCUMENTATION:

PUMP	PUMP ASSAY	VERSION BOARD	DRAWING	DESCRIPTION
PW	AY0238.01	EB0161.05	EB0161.05.0.SC	Pump stepper motor drive – Electrical diagram, see „21.4 Documentation“
			EB0161.05.0.PM	Pump stepper motor drive – Assembly drawing, see „21.4 Documentation“
PA	AY0238.02	EB0161.06	EB0161.06.0.SC	Pump stepper motor drive – Electrical diagram, see „21.4 Documentation“
			EB0161.06.0.PM	Pump stepper motor drive – Assembly drawing, see „21.4 Documentation“

Version	Range (mV)	Current (A)	ADJ	Jumpers settings JPX, O=Open, C=Closed							
				2	5	6	7	14	15	16	
EB0161.05	800 ± 10	0,5	TP7	C	C	2-3	C	C	1-2	2-3	WASTE PUMP
EB0161.06	800 ± 10	0,5	TP7	C	C	2-3	C	C	2-3	2-3	CAL. A PUMP

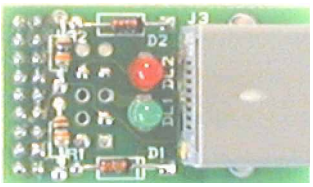
Led	Color	
DL1	Red	+12 V power supply

DL2	Green	+5 V power supply
DL3	Yellow	Enable Low power

21.3.5 SERIAL ADAPTER BOARD (P/N: EB0171.01)

Function of this board is:

- Interface the signals RS-232 from COM2 port of Master PC to ISE module by means a RJ45 connector.
- LED Red-Green (blinking) – indicates that there's a TX-RX serial transmission via the serial port.



DOCUMENTATION

EB0171.01.0.SC Serial adapter board – Electrical diagram, see „21.4 Documentation"

EB0171.01.0.PM Serial adapter board – Assembly drawing, see „21.4 Documentation"

21.3.6 POWER SUPPLY FOR THE ISE MODULE

After having installed the electrodes, the **module must be always ON**, even when the analyzer is turned OFF. The ISE electrodes have to be kept moist at all times, even during standby. Every 30 min. a small quantity of Calibrator A is being pumped through by pump (PA „Figure 81") to calibrate and be ready to operate.

Check periodically the liquid level of the Calibrator A in the container (at least one control weekly).

Insert the power plug from the module located in the back of the Analyzer, directly into a socket of 230 or 115Vac.

21.3.7 REAGENTS AND SOLUTIONS NEEDED

The ISE Module for operation requires the following:

1. "**Calibrator A**" Reagent): **is used both as Wash Solution and as one point calibration after each sample**. Daily consumption is about 24 ml in operation, with included 100 samples to day for Na, K, e Cl in 8 hours of work, plus 16 hours 3 in stand by position.

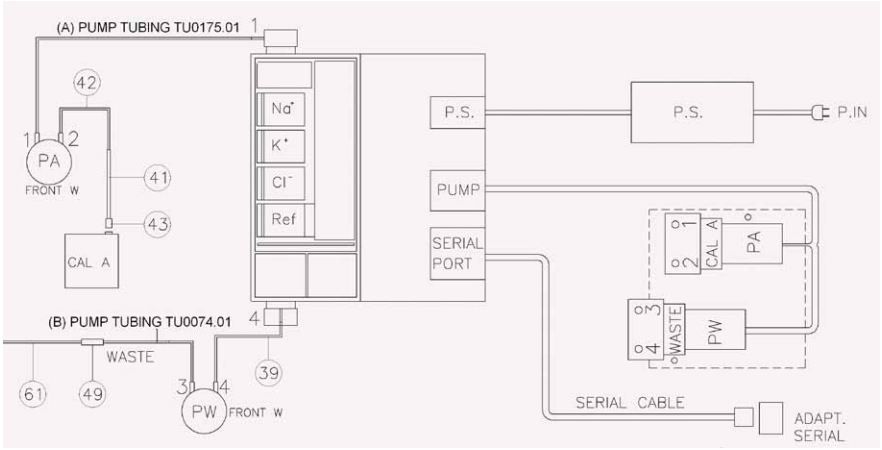
2. "**Calibrator B**" (calibration only) - is used as a second point calibration. It is used as sample recommend running daily. Consumption about 400 µl when calibrating.
3. "**Cleaning Solution**" Used once or twice a day, depending on the number of samples to be run. It is used to clean the electrodes and prevent protein build-up. It is used as a sample and the daily consumption is about 400 µl.
4. "**Urine Diluent**" Required for Urine samples only. Urine must be diluted 1/10. The dilution is done automatically on the Analyzer in an OFF-Line mode.

21.3.8 THE ISE MODULE PARTS

The module is supplied with the following parts:

1. Four Electrodes. Na, K, Cl and Reference
2. Pump PA - transfers the Calibrator A through the electrodes
3. Pump PW – empties the electrodes channel after each sample and carries liquids to Waste.
4. The liquid of discharges is automatically eliminated into the container of the Analyzer.
5. The three methods, Sodium, Potassium and Chlorine don't require programming. The Samples and Reagents volumes are automatically checked from ISE module and Master PC connected between them. by means a serial line connected through the ISE module and the Master PC of Analyzer.

FIGURE 86
Connecting diagramm



Important:the Module has to be installed in factory or by Crony authorized personnel.

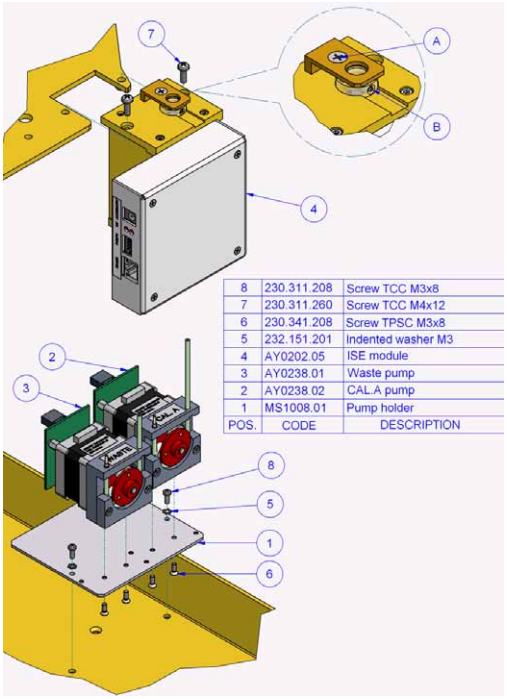
The electrodes once installed will perform for a period of 6 months or 10,000 tests whichever is sooner.

21.3.9 MOUNTING AND CONNECTING

When installing the ISE Module for the first time into the HumaStar HS300SR, follow exactly the procedure described below:

21.3.9.1 Assemblies ISE Module and Pumps

1. Loosen the screw (A) that holds the inlet sample cup (B) of module (4).
2. Rotate the inlet sample cup (B), so that it has the enters tubing in direction as shown in Fig. on side, then tighten screw (A).



POS.	CODE	DESCRIPTION
8	230.311.208	Screw TCC M3x8
7	230.311.260	Screw TCC M4x12
6	230.341.208	Screw TPSC M3x8
5	232.151.201	Indented washer M3
4	AY0202.05	ISE module
3	AY0238.01	Waste pump
2	AY0238.02	CAL.A pump
1	MS1008.01	Pump holder

! To make easy the operation, it's suggest before to install the module on the measuring holder, connect both tubing, (39) to waste connector (4) and (TU0175.01) to sample cup (1) see „Figure 89").

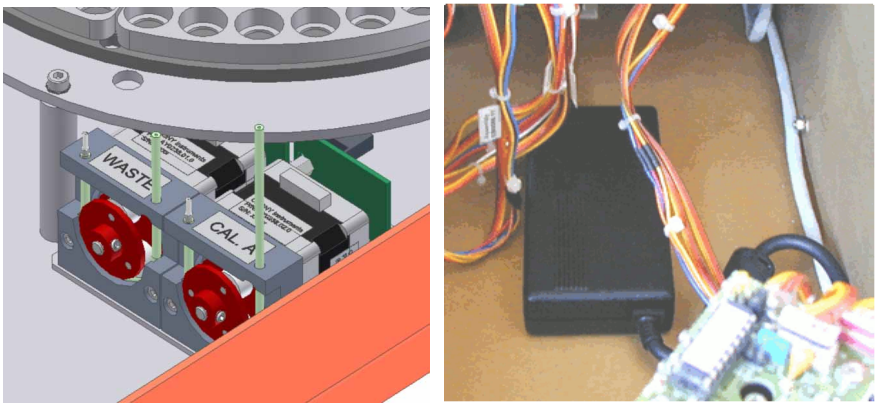
FIGURE 87

3. Position the module on the measurement holder plate and lock it with the two screws (7), (see „Figure 82"and „Figure 83").

FIGURE 88

4. Assemble the two pumps (2) and (3) on its holding panel (1) using screws (6), to keep the right position (see „Figure 82“ and „Figure 84“.
5. Position the two pumps assay on analyzer base under the sampling tray (see „Figure 84“) and lock them with the two screws (8) (see „Figure 82“).
6. Position the power supply (PS) on the analyzer base in the place indicated in the „Figure 84“. To hold it, use two sided adhesive tape.

FIGURE 89



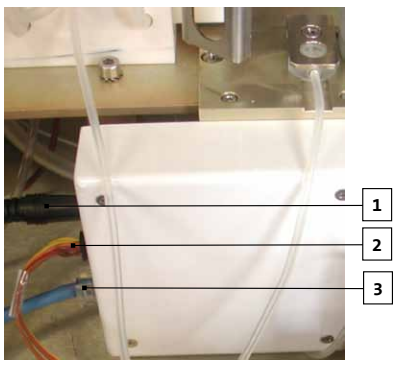
21.3.9.2 Electrical Connections

FIGURE 90

1 12V
2 Pumps
3 RS232

The ISE Module consists of the following electrical parts:

- ISE Module
- Universal Power Supply (PS) suitable to input voltages of 110 - 230 Vac
- Two pumps (PW – PA)
- Cord for serial connection



1. Insert the input cord from the power supply (PS) through the hole present on the right side in the back of the analyzer (front view, see „Figure 84“).
2. Connect the output connector from the Universal Power supply to the +12 V socket of the ISE module (see „Figure 85“).
3. Connect the pumps cable connectors one to the ISE module into socket PUMPS and others on the pump drive board socket without distinction (see „Figure 85“).

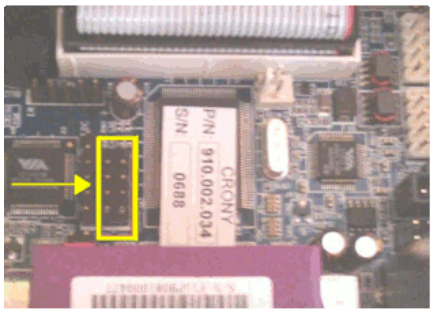


FIGURE 91
Connecting internal serial port COM2

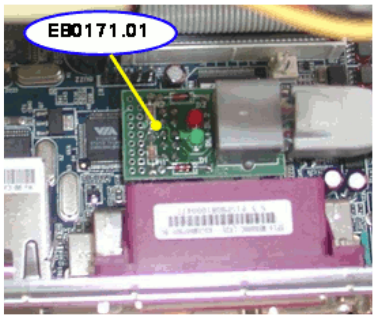


FIGURE 92

4. Insert the EB0171.01 serial adapter board, on its connector COM 2 of the Master PC (see „Figure 87“).
5. Connect a side of cord RS232 to the serial port (COM2) from the Master PC board, via EB0171.01 serial adapter board LAN-9DB.
6. Fix the cord with plastic clamp.
7. Give the other side of cord RS232 into the its inferior side through the hole near the PC Master board, then position the two cables (RS232l and Power out) along the right side and onward (frontal view), until to the ISE module (see „Figure 84“ and „Figure 85“).
8. Connect the Power and RS232 cable to the ISE module connectors.

The module has two LED signals next to the electrical connectors.
- LED Red (ON): Indicates that the ISE module is ON
- LED Red (blinking): indicates that the ISE module is ready to receive or to transmit data via serial line

The serial adapter board has two LED signals indicating:
- LED DL1 Green (blinking) – indicates that there’s serial transmission from ISE module
- LED DL2 Red (blinking) – indicates that there’s serial transmission from the Master PC

21.3.9.3 Hydraulic Connections

Connecting procedure: (see „Figure 88“ / „Figure 89“ and section 14° “Hydraulics system“ of this technical manual.

1. Connect input tubing (42) from (PA) pump to its Reagent bottle through the tubing (41) that pass all long the front panel toward the left side until the Reagent compartment.
2. Connect the input tubing from the (PA). pump to its input sample connector (1).

! To skip steps 2 and 3 if already done previously, „21.3.9.1 Assemblies ISE Module and Pumps“, point 2.

3. Connect the output tubing (39) from the (PW) pump to the waste connector (4) located under the ISE Module.
4. Connect the waste tubing (61) from its (PW) pump, into the internal waste chamber connector (3) through the joint (49).

FIGURE 93
Hydraulics connections

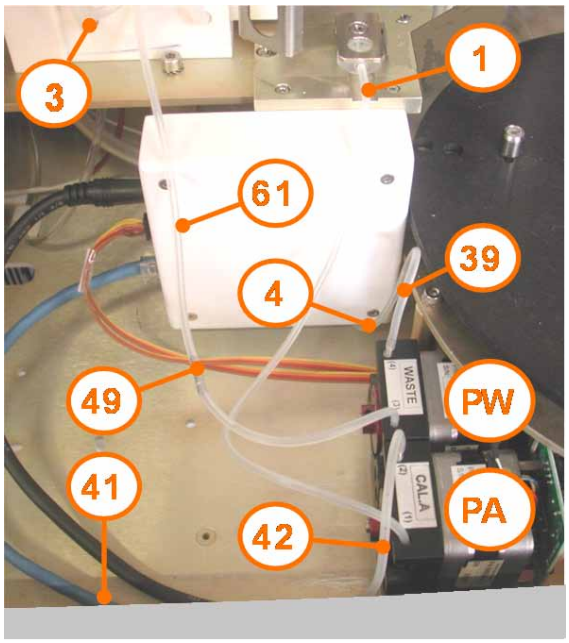
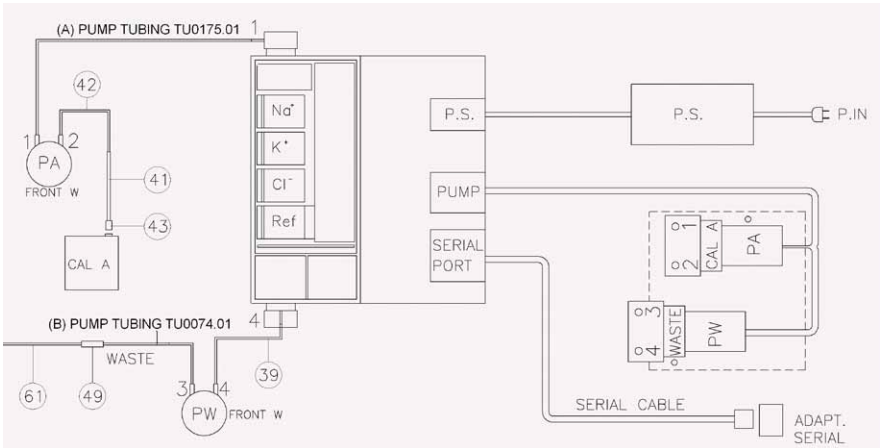


FIGURE 94
ISE Module connections



21.3.9.4 Hydraulics parts list

CODE	REF. „Figure 89“	DESCRIPTION	QTY
MS1606.01	(4)	Waste hydraulic connector	1
MS1603.01	(1)	Sample & Calibrator A cup	1
TU0074.01	39 – (B)	ISE waste & pump waste tubing	2
TU0098.02	41	Calibrator (A) Silicone tubing	1
TU0077.01	42	Calibrator (A) Teflon tubing	1
17941	43	Sensor cup Calibrator (A)	1
MS1438.01	49	Join connector in steel	1
TU0179.01	61	Extent Waste tubing	1
TU0175.01	(A)	Pump A tubing	1
AY0238.02	(PA)	Pump Calibrator A	1
AY0238.01	(PW)	Pump waste	1

21.3.10 OPERATIVE PROCEDURE

After the assembling and electric-hydraulics connections, it’s necessary verify the correct operation across the diagnostic program Tester.

Click on **[Test ISE]** button, to start the two pumps and implement a washing cycle of ISE module, after few seconds the result will be displayed on the screen as follows:

- **ISE Ready: it’s ready to work**
- **ISE NOT ready: it has problems of operation, or the serial line between the Master PC and ISE module is missing or bad (see all connections), or the signal of the air bubble detector on TP13 of ISE control board code N° EB0181.02, does not work properly (see „21.3.3.1 How changes the air bubble signal (TP13) during a purge cycle“).**

It is recommended to calibrate the ISE module daily, together with all the other methods of clinical chemistry.

Place some 500 µl of Calibrator B into a plastic sample cup and another cup with 500 µ of Clean S solution and place them both into their reserved places on the Sample Tray. Use fresh cups and fresh solutions daily, DO NOT add fresh solutions to the cups of the day before.

Program the calibration for Na, K, and Cl together with all the other methods daily. We also suggest to run at least one or two Serum Controls daily, it will take only two minutes more, but it will confirm the correct operation of the analyzer.

Calibration:

1. An aliquot of "**Clean S**" solution is transferred from the Sample tray into the module to clean the electrodes.
2. Automatically the electrodes are rinsed and cleaned with "**Calibrator A**" and measured the first calibration point.
3. Finally the "**Calibrator B**" is transferred twice and the second calibration point is measured.
4. It the calibration is correct (OK). A massage will be displayed with their calibration values.
5. Should there be a problem in the first calibration, a massage will be displayed indicating the problem. Repeat Calibration.
6. Should the problem persist, refer to the Trouble Shooting Guide below.

! When a programmed calibration has not been successful, due to a faulty electrode or missing Cal A or Cal B. etc, the ISE Module cannot operate properly. In case: a) Only one of the three electrodes is faulty, the analyzer will report the values of the other two. b) If no daily calibration has been done or programmed, the analyzer will run the tests using the values of the last calibration done. In any case we highly recommend to run at least one or two Serum Controls to assure that the results are correct.

To assure the correct operation of the system and to update the Quality Control Program, it is recommended to run at least one or two serum controls daily.

When the ISE Module is in Standby in order to maintain the electrodes moist and ready for operation, every 30 min. a small quantity of "**Calibrator A**" is automatically aspirated.

21.3.11 URINE DETERMINATION

Urine samples are determined separately, with automatic pre-dilution, before the tests on serum and plasma.
There is an automatic check made on the Standards that have to be below 10% of the previously calibrated data.

21.3.12 MAINTENANCE

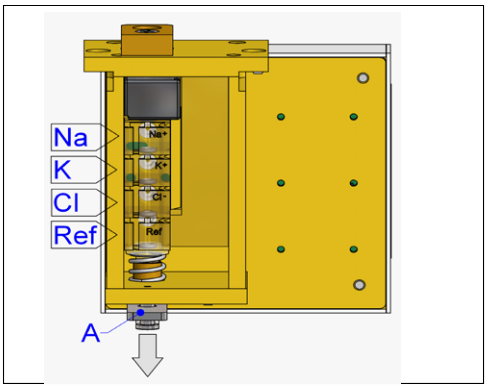
21.3.12.1 Replace Electrodes

The electrodes once installed will perform for a period of 6 months or 10,000 tests.
Thereafter it is possible to have difficulty in calibration and doubtful results.
In case of a faulty electrode, the software will generate a **ERROR code** message next to the result like **Error ISE.....**

See „Figure 90“, shows the module with its four electrodes.

To simplify the replacement of the electrodes, the best way is to remove the module from the analyzer, replace the electrodes and reassemble. Fist of to replace the electrodes, it’s necessary to purge the hydraulic circuit of ISE module as follows:

1. Take out the sensor cup from the “Calibrator A“.
2. To perform 10 cycles of washing, after power OFF the analyzer, remove the work panel and ISE module, then to continue as follows:
3. Press down lever (A) to remove the faulty electrode.
4. Use the same O-ring, to protect the electrode or use a new.
5. Press down the lever (A) to insert the new electrode. Make sure the electrode is inserted correctly.



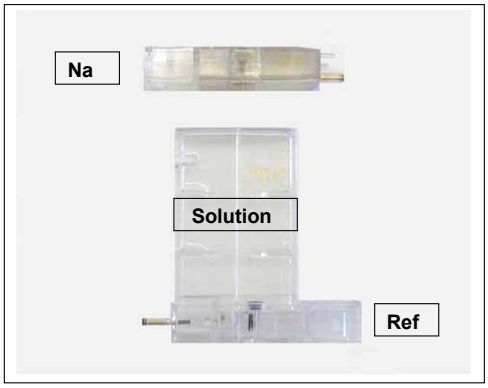


FIGURE 95

All four electrodes have to be aligned with the same distance from each other. Make sure to hear a click when the electrode is inserted.
The electrodes installed will perform for a period of 6 months or 10,000 test.

! **Every SIX months or when necessary, To ensure an accurate maintenance of the ISE module, it's suggest to wash some parts as sample cup, waste connector with good detergent used for laboratory, then rinse everything several time with BI-distilled water.**

21.3.12.2 ISE control board and accessories replacement

Follow these operations, if there has been a leak of liquid through the electrodes channel, or because some components are damaged, see „Figure 91".

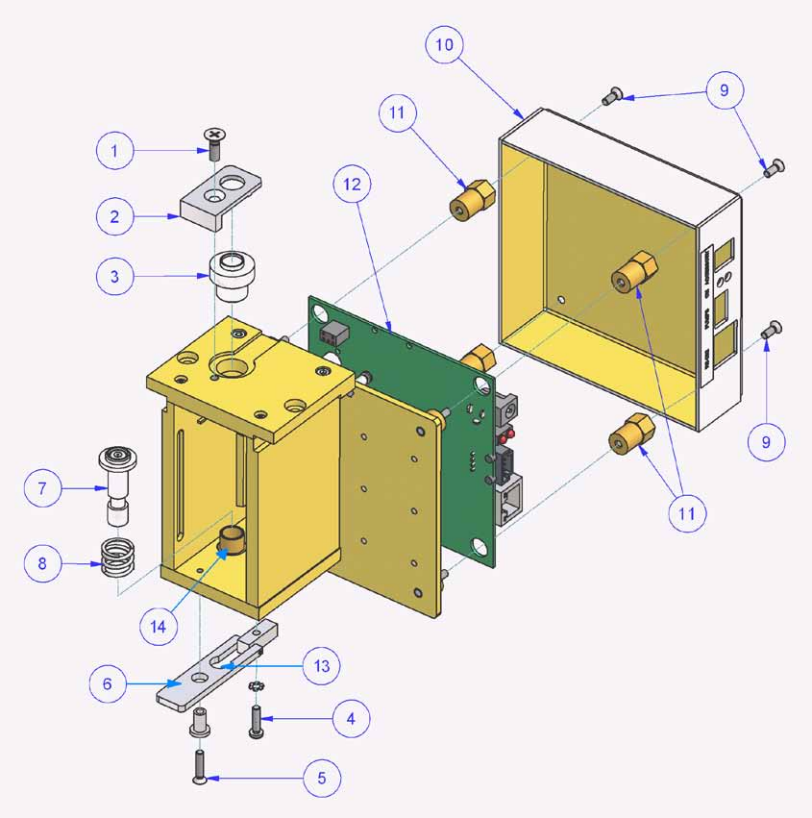


FIGURE 96

1. Fist of staring this procedure, it's necessary to purge the hydraulic circuit of ISE module for empty the electrodes channel, see „21.3.12.1 Replace Electrodes", points 1-2.
2. Take out all the electrodes and air bubbles detector.
3. Remove the ISE module from the measuring holder assay of the analyzer, see „21.3.9.1 Assemblies ISE Module and Pumps".
4. **REPLACE ISE CONTROL BOARD (12):** remove the four screws (9) and take out the cover (10).
5. Unscrew the four knob (11) and to extract the PCB, when remounting the PCB make sure that the terminals of the air bubbles detector is well inserted into the connector to six ways mounted on the PCB (12).
6. **REPLACE SAMPLE CUP (3):** remove screw (1), take out in sequence the holder (2) and sample cup (3).

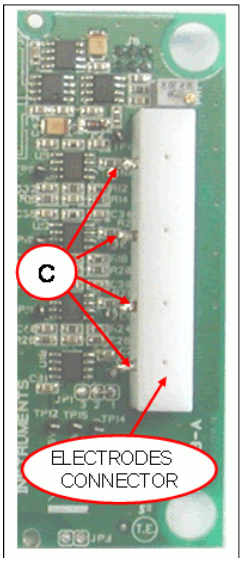
7. **REPLACE WASTE CONNECTOR (7) and SPRING (8):** remove the screws (4) (5) to take out the lever (6).
8. To extract from the top the waste connector (7) and spring (8).
9. Reassemble in order; spring (8), waste connector (7) on support (13), than to insert the lever (6) through the hole (14) on the waste connector (7), after fix the screws (4) (5).
10. After having inserted this mechanics components, check the correct operation of the compression spring, pressing the lever (6).
11. Once that the mechanism has been repositioned well, reassemble the everything, starting in sequence from the reference electrode than Cl, K, Na and air bubbles detector, at end to position the sample cup with its holder (2) then tighten the holding screws (1).
12. Proceed to check the operation of ISE module as described above in paragraph 16.3.10.

21.3.12.3 ISE Accessories Parts List

CODE	REF. „Figure 91“	DESCRIPTION	QTY
MS1603.01	3	Sample cup	1
MS1606.01	7	Waste connector	1
MS1612.01	8	Compression spring	1

21.3.12.4 To substitute the electrical contacts in ISE control board

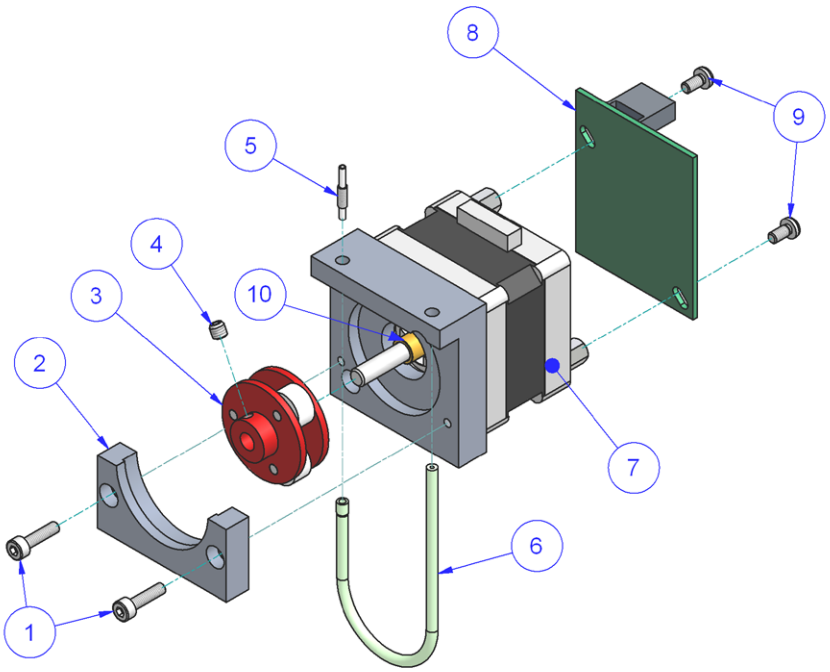
1. Remove the board as described in the „21.3.12.2 ISE control board and accessories replacement“, points 1-4.
2. Unsolder the four wire (C) from the board, see image on side
3. Remove the three screws holding the electrodes connector from the solder side of PCB and take out it.
4. Replace with original part code N° MC0198.01 and reassemble everything in reverse.
5. Check the operation of all contacts, pressing on the contact with a screwdriver and verifying if the spring inside it work properly without impediments.



21.3.12.5 Maintenance ISE pump

Follow „Figure 92“.

FIGURE 97



6. Remove the peristaltic pumps assay from the analyzer „Figure 82“.
7. Remove the pump from the holder plate
8. **REPLACE TUBING (6):** remove the screws (1) and take off the holder tubing (2)
9. **Replace the tubing (6)** with original part after having inserted the joint connector (5) (pay attention to the version - see „21.3.9.4 Hydraulics parts list“)
10. **REPLACE ROTOR (3):** loosen the screw (4) and to extract the wheel (pay attention do not to lose the spacer (10)
11. **REPLACE PUMP DRIVE BOARD (8):** disconnect the pump connector, than remove the screws (9) and take out the PCB
12. Reassemble everything following the reverse procedure

21.3.12.6 Pumps Accessories Parts List

CODE	REF. FIG.20.3-8	DESCRIPTION	QTY
TU0074.01	6	Pump waste tubing	1
TU0175.01	6	Pump Cal.A tubing	1
MC0199.01	3	Pump rotor	1

MS1621.01	5	Pump joint connector in steel	1
EM0045.03	7	Pump motor	1
MS1619.01	2	Tubing holder	1
EB0161.05	8	Waste pump drive board	1
EB0161.06	8	Cal. A pump drive board	1

21.3.13 TROUBLE SHOOTING GUIDE

In some case it may be difficult to calibrate the ISE Module, especially if it is not used daily. However, it is easy to check and redo the calibration from the Maintenance F8 program. It is possible to clean and wash several times the electrodes and proceed to calibrate without a problem.

Go to Maintenance F8 program – Sample System and proceed as follows:

1. Activate – **ISE Clean** and click **START**. Repeat this operation at least twice. Make sure that the cup with **CLEAN S** solution is present on the Sample Tray in its position.
2. Activate – **ISE Purge** and click **START**. Repeat this operation at least three times.
3. Activate – **ISE Calibration** and click **START**. Repeat the operation twice. Make sure the cup with **fresh** "**Cal B**" solution is present in its position on the Sample Tray.
4. The results obtained should be within the values shown below:
   - Cal Na - from 50 a 63 mv/ d
   - Cal K - from 50 a 63 mv/d
   - Cal Cl - from 40 a 53 mv/d

This operation will be necessary, especially if the ISE Module has not been used for a long time or when the electrodes are dirty or old.

The test above indicates that the ISE Module is working correctly. If the above results are not obtained, the module might need special maintenance or service. Two possible situations can occur:

1. One or more results during calibration are not within the specified range.
- It is possible that the electrode is old and exhausted. Next to the result that is out of range will be added the (**Error ISE...**).
2. None of the results are within the specified range
- The problem can also be the Reference electrode; in that case a massage is displayed. (Check the solution inside the Reference electrode; there is a little marble inside that controls the salinity of the solution. If the marble is on

the bottom the solution is good, if the marble is floating the solution has deteriorated and the Electrode has to be changed).

- The problem can also be, an old or contaminated solution of Cal A and Cal B.

The ISE module can to send to the operator, 5 different **errors messages**:

Defect Found	Cause and Remedy
Error ISEc (Air bubbles in the Calibrator A)	1. Check the liquid level of the Calibrator A in the container. 2. Make sure that the pumps (PA) and (PW) works properly. 3. Check that the liquid of the Calibrator A is aspirated and transferred into the ISE module without. 4. Make sure that the liquid drainage under the module works properly and is not blocked. C 5. heck the flag air bubble on TP13 of board EB0181.02, 6. Replace the air bubble detector inside the ISE module.
Error ISEa (Air bubbles during the calibration)	1. Check the points above.
Error ISEn (Electrical noise during the measurement)	1. Check the points above. 2. Empty the fluidics circuit and power OFF the ISE module. Remove the ISE module from the instrument, then remove all the electrodes and to clean.
Error ISEd (Fluidic problem inside the ISE model)	1. Check the points above.
Error ISEo (Values out range)	1. Check the points above. 2. Replace the electrode out range. 3. If all the electrodes are out range, replace only the reference electrode.

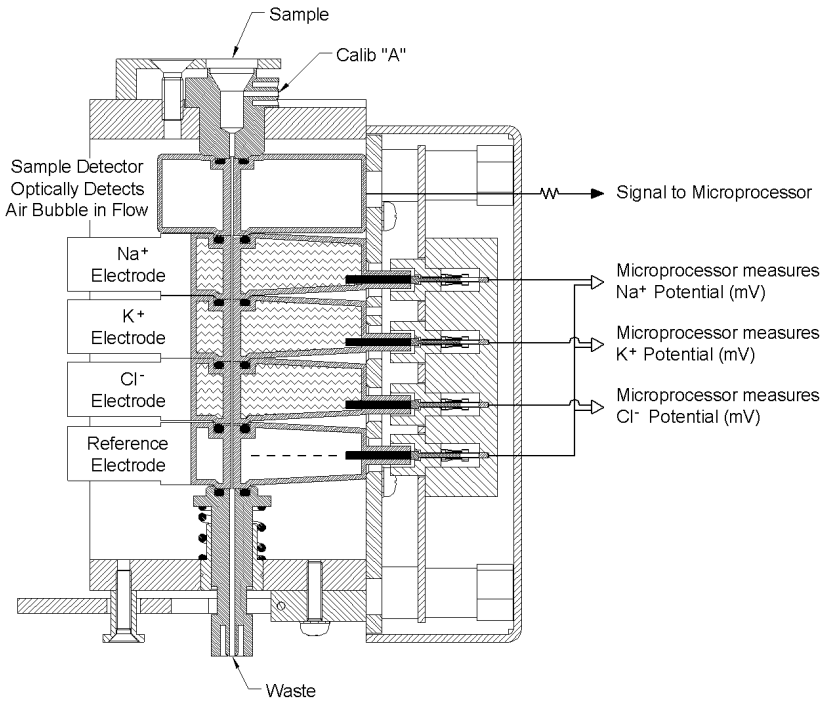
21.3.14 SPARE PART LIST

When ordering parts make sure to mention:
Code Number – Description & Quantity.

! To assure a fast and efficient technical service to the users, Crony Instruments suggests to keep in stock the parts indicated with (•).

P/N		DESCRIPTION	QTY
KG0019.04		**KIT complete ISE module**	
166.050.050		Adhesive tape to power supply l=90	1
276.012.010		Adhesive wire cord clip	4
276.012.016		Adhesive tubing clip	4
310.009.009		Serial cable	1
930.020.016		Power supply	1
17941		Level sensor cap for Cal.A container	1
AY0136.04		Assembly drawing ISE module + Dis.P9	1
EB0171.01		Serial adapter	1
TU0148.01		Aspiration tubing CAL. A (Silicon)	1
MS1046.01		Container 250 mL	1
TU0074.01		Connecting tubing waste container	1
TU0077.01		Aspiration tubing CAL. A (Teflon)	1
WC0164.01		Power supply cable	1
AY0136.04		**Assembly drawing ISE module**	**1**
161.035.004	•	Calibrator A 250 ml	1
161.035.016	•	Calibrator B 125 ml	1
161.035.021	•	Cleaning solution 125 ml	1
230.311.260		Screw TCC M4x12	2
232.151.201		Indented washer for M3	2
230.311.208		Screw TCC M3x8	2
MS1008.01		Pump holder	1
230.341.208		Screw TPSC M3x8	4
AY0238.02	•	Calibrant A pump	1
AY0238.01	•	Waste pump	1
AY0202.05		ISE Module	1
MS1438.01		Tubing connection	1
TU0179.01		ISE waste tubing	1
TU0098.02		Joint tubing for ISE	1
WC0170.01		Pump connecting cable	1
AY0202.05			
MA0199.01		ISE Module	1
EB0181.02		ISE board	1
AY0202.05		Identification label	1
AL0089.01		Connecting label	1
805.004.012	•	Bubble detector assembly	1
805.004.009	•	Cl electrode	1
805.004.008	•	Na electrode	1
805.004.007	•	K electrode	1

805.004.006	•	Reference electrode	1
EB0161.05		**PW pump driver**	
EB0161.06		**PA pump driver**	
EB0181.02		**ISE control board**	



Analyzer One			
	Sodium	Potassium	Chlorine
	134	4.10	98
	132	4.00	97
	132	4.00	97
	132	4.00	97
	132	4.10	97
	132	4.10	97
	131	4.10	97
	131	4.10	97
	131	4.10	97
	132	4.00	96
mean	131.90	4.06	97.00
SD	0.88	0.05	0.47
CV%	0.66	1.27	0.49

Potassium			
	Sodium	Potassium	Chlorine
	135	3.80	98
	131	3.80	97
	131	3.80	98
	131	3.80	98
	131	3.80	97
	131	3.80	97
	132	3.80	97
	132	3.80	98
mean	131.75	3.80	97.50
SD	1.39	0.00	0.53
CV%	1.05	0.00	0.55

Analyzer Three			
	Sodium	Potassium	Chlorine
	150	6.90	111
	151	6.90	110
	151	7.00	110
	150	7.00	110
	151	7.00	110
	151	7.00	110
	153	7.00	110
	152	7.10	111
	150	7.10	110
	151	7.00	110
mean	151.00	7.00	110.20
SD	0.9428	0.07	0.42
CV%	0.6244	0.95	0.38

Analyzer Four			
	Sodium	Potassium	Chlorine
	150	6.90	110
	150	6.90	110
	149	6.90	110
	149	6.90	111
	153	7.10	109
	151	7.10	110
	151	7.10	110
	150	7.10	110
	150	7.10	110
	151	7.10	110
mean	150.40	7.02	110.00
SD	1.17	0.10	0.47
CV%	0.78	1.47	0.43

21.4 Documentation

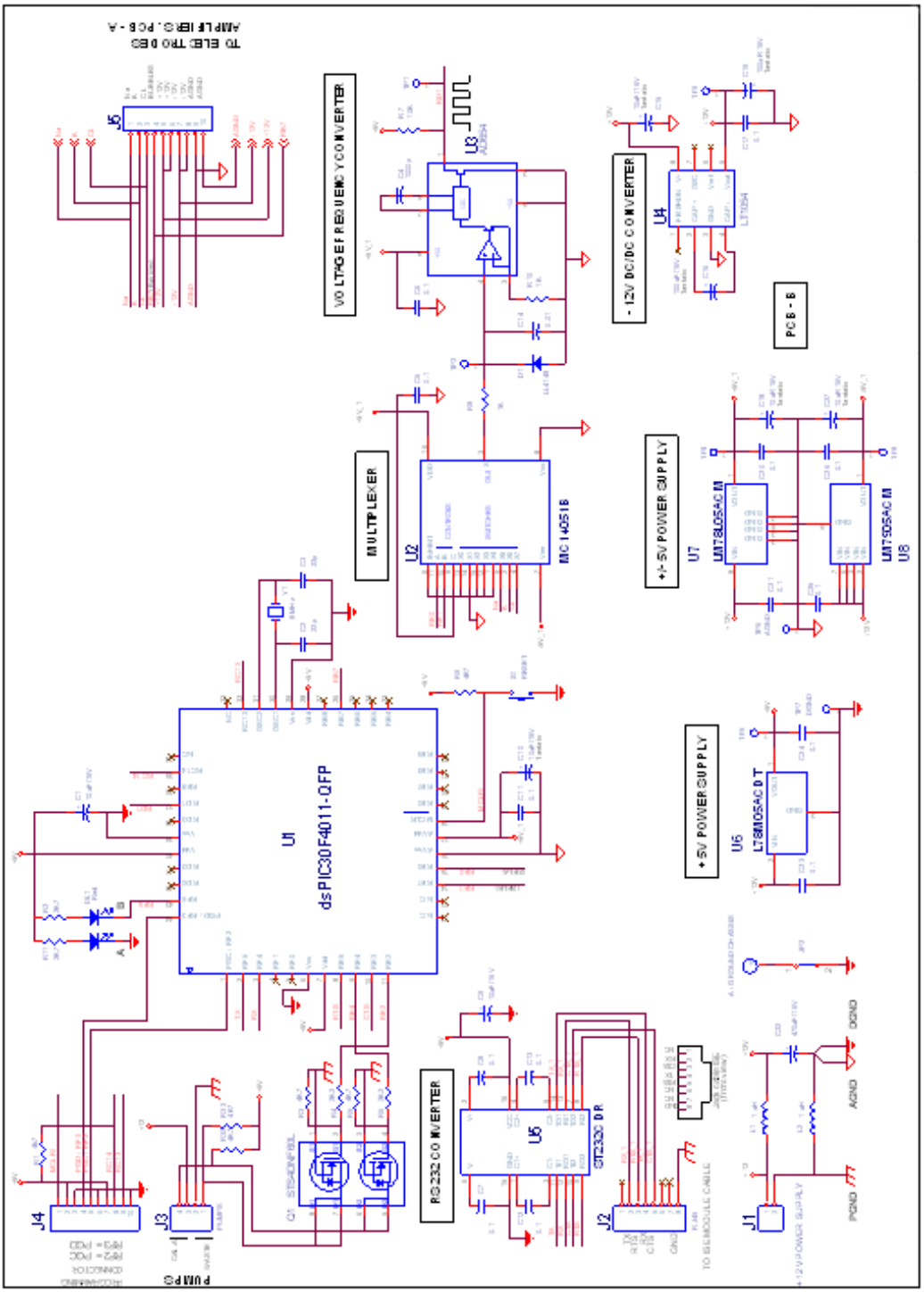


FIGURE 98
ISE module control board - Electrical diagram, pg 1-2

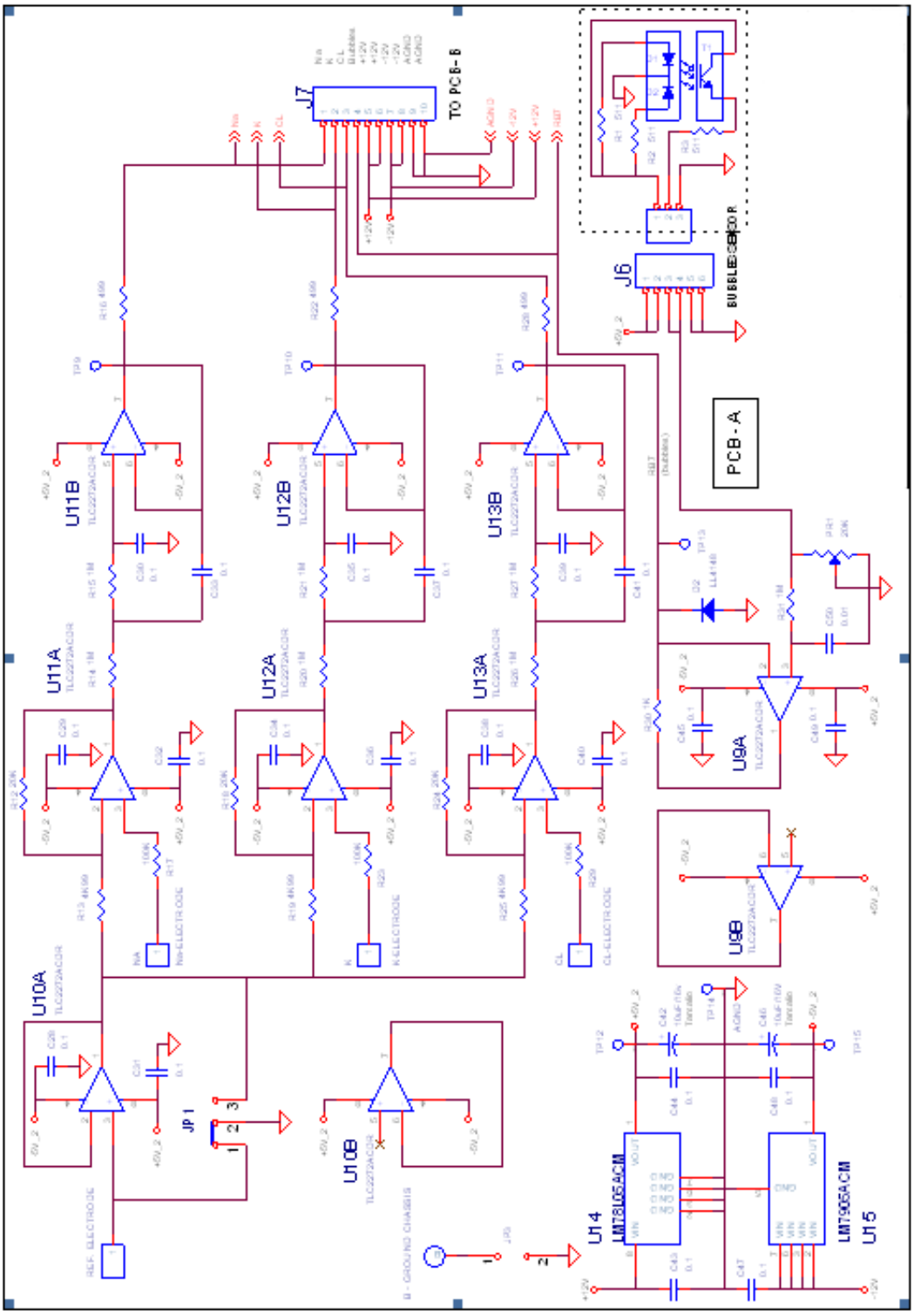
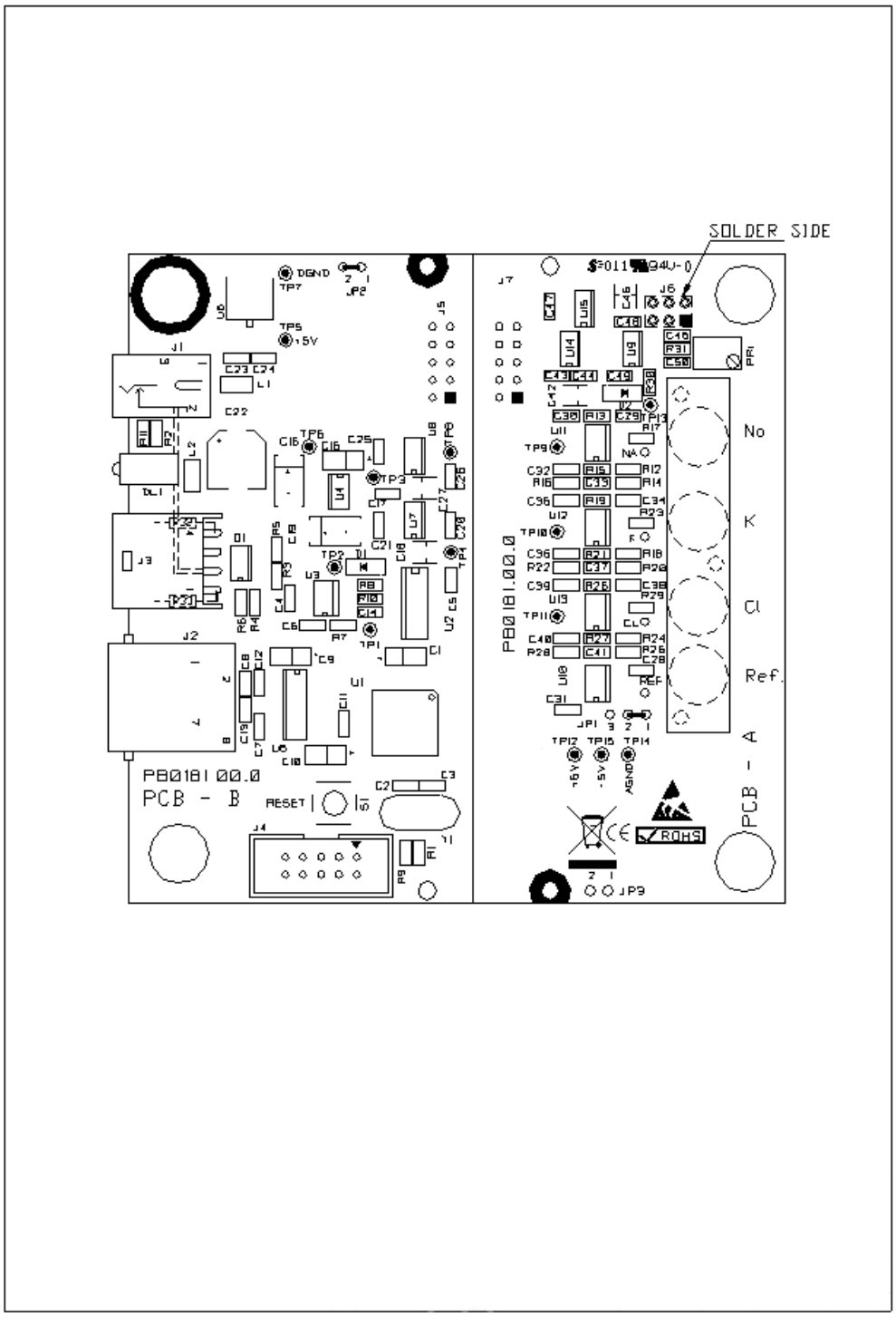


FIGURE 99
ISE module control board - Electrical diagram, pg 2-2

FIGURE 100
ISE control board - Assembly drawing



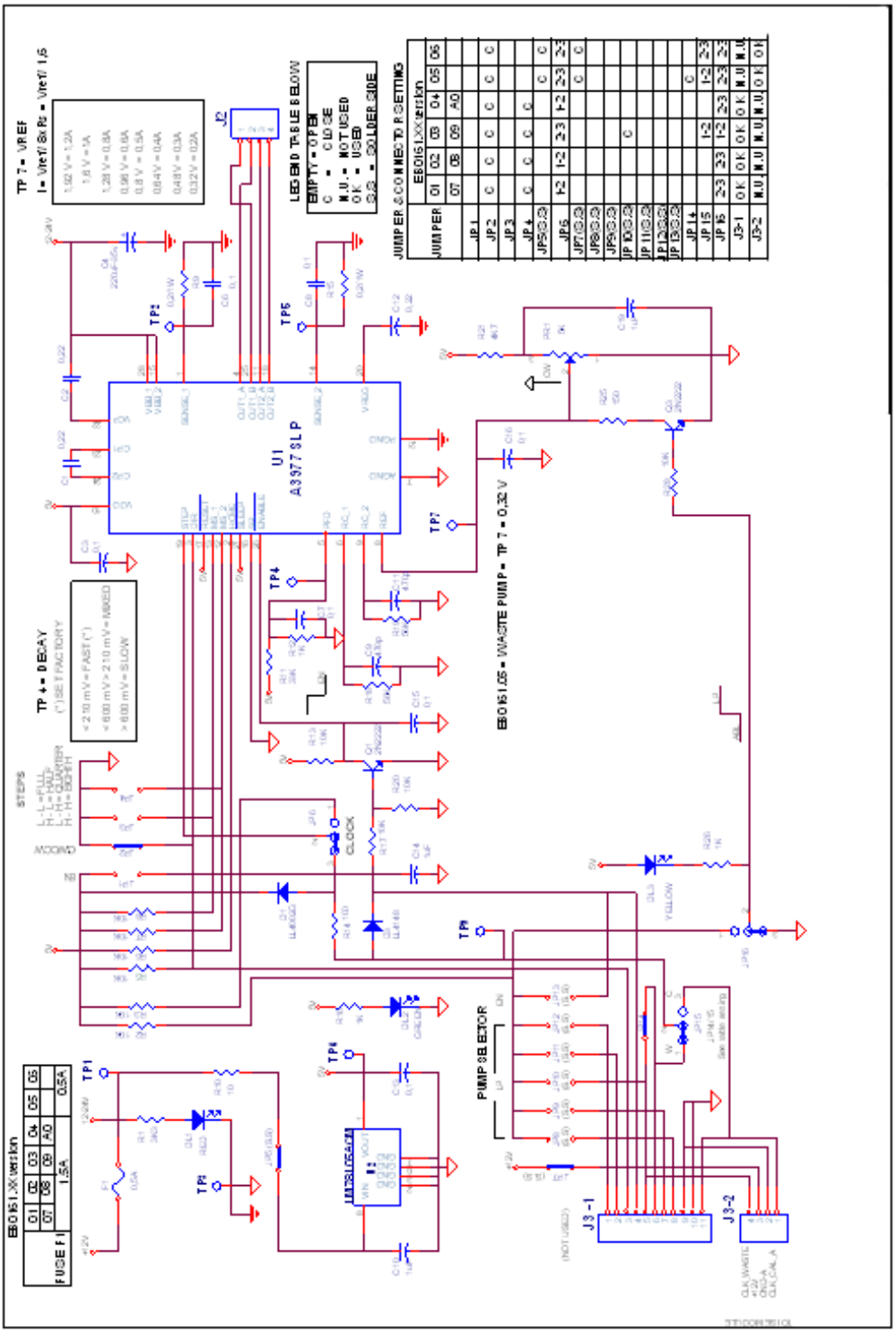
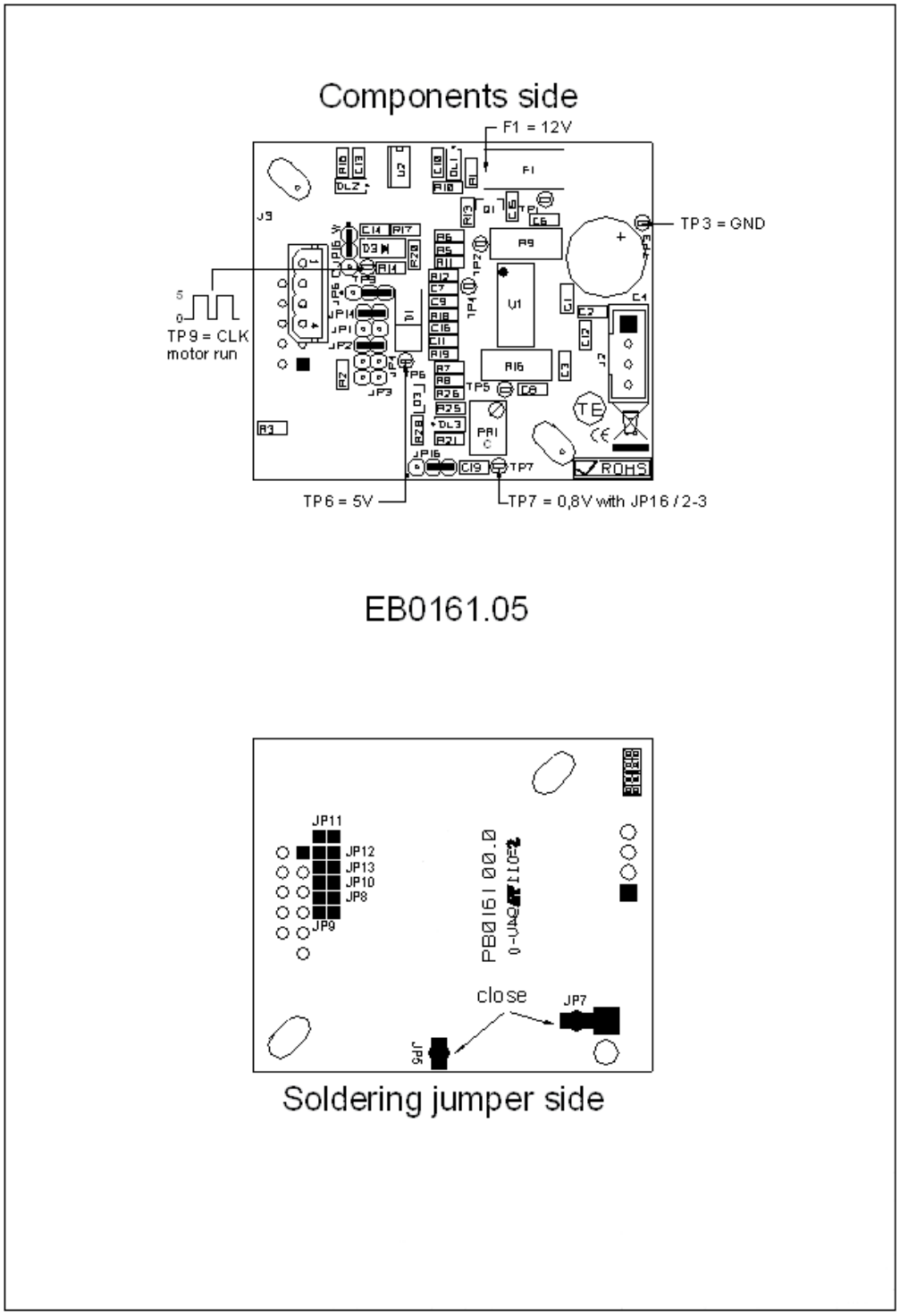


FIGURE 101
Pump stepper motor drive - Electrical diagram

FIGURE 102
Pump stepper motor drive - Assembly drawing



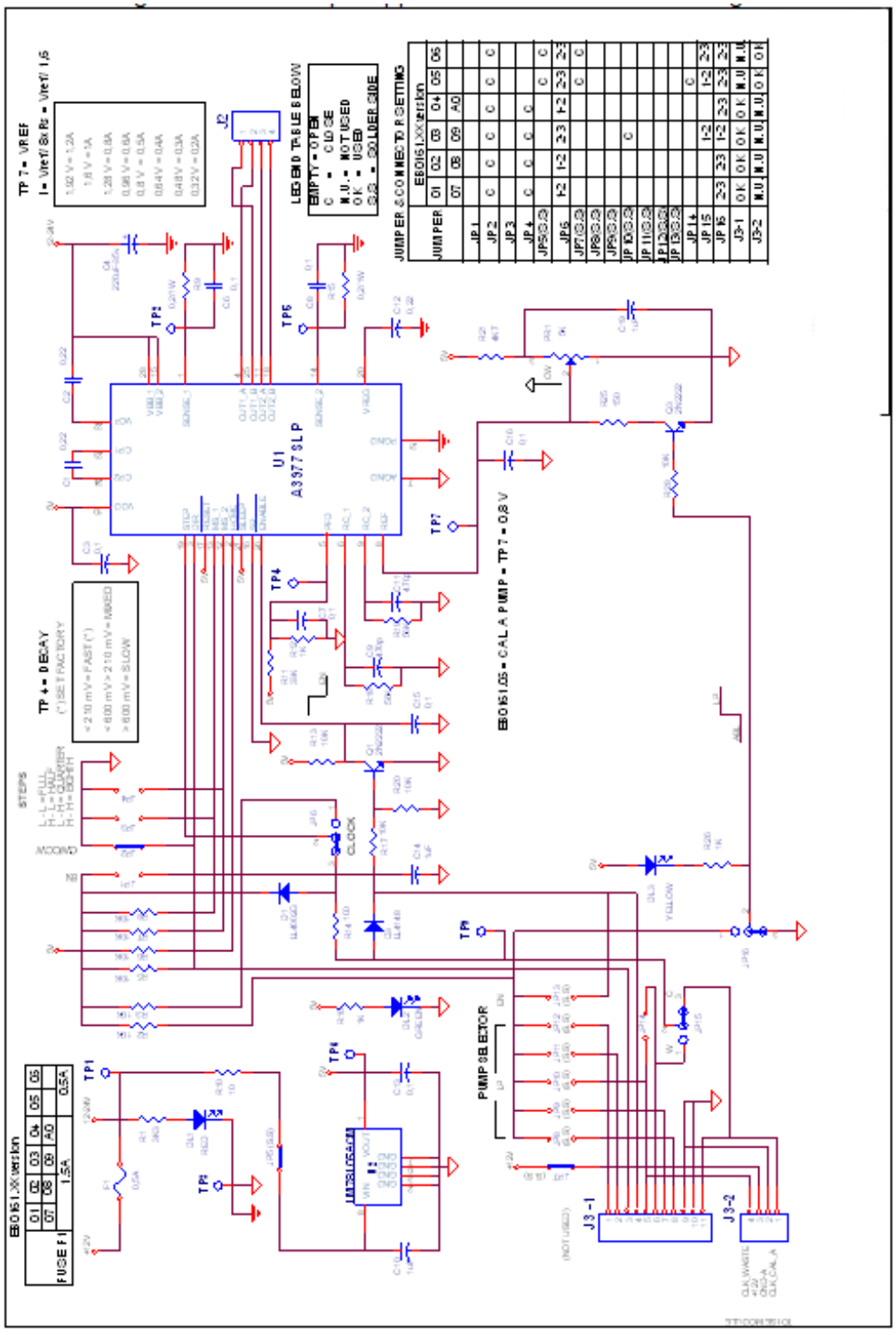
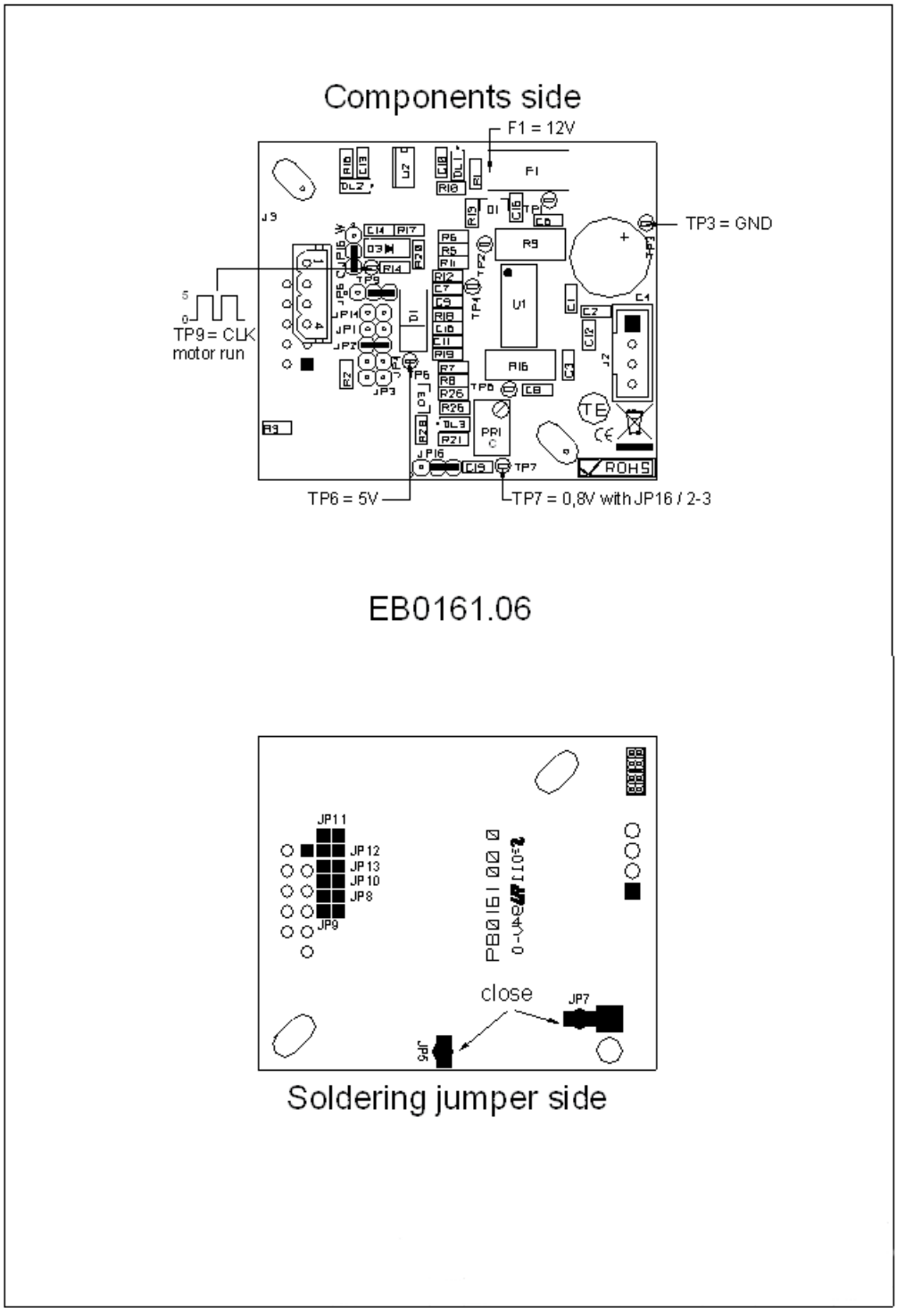


FIGURE 103
Pump stepper motor drive - Electrical diagram

FIGURE 104
Pump stepper motor drive - Assembly drawing



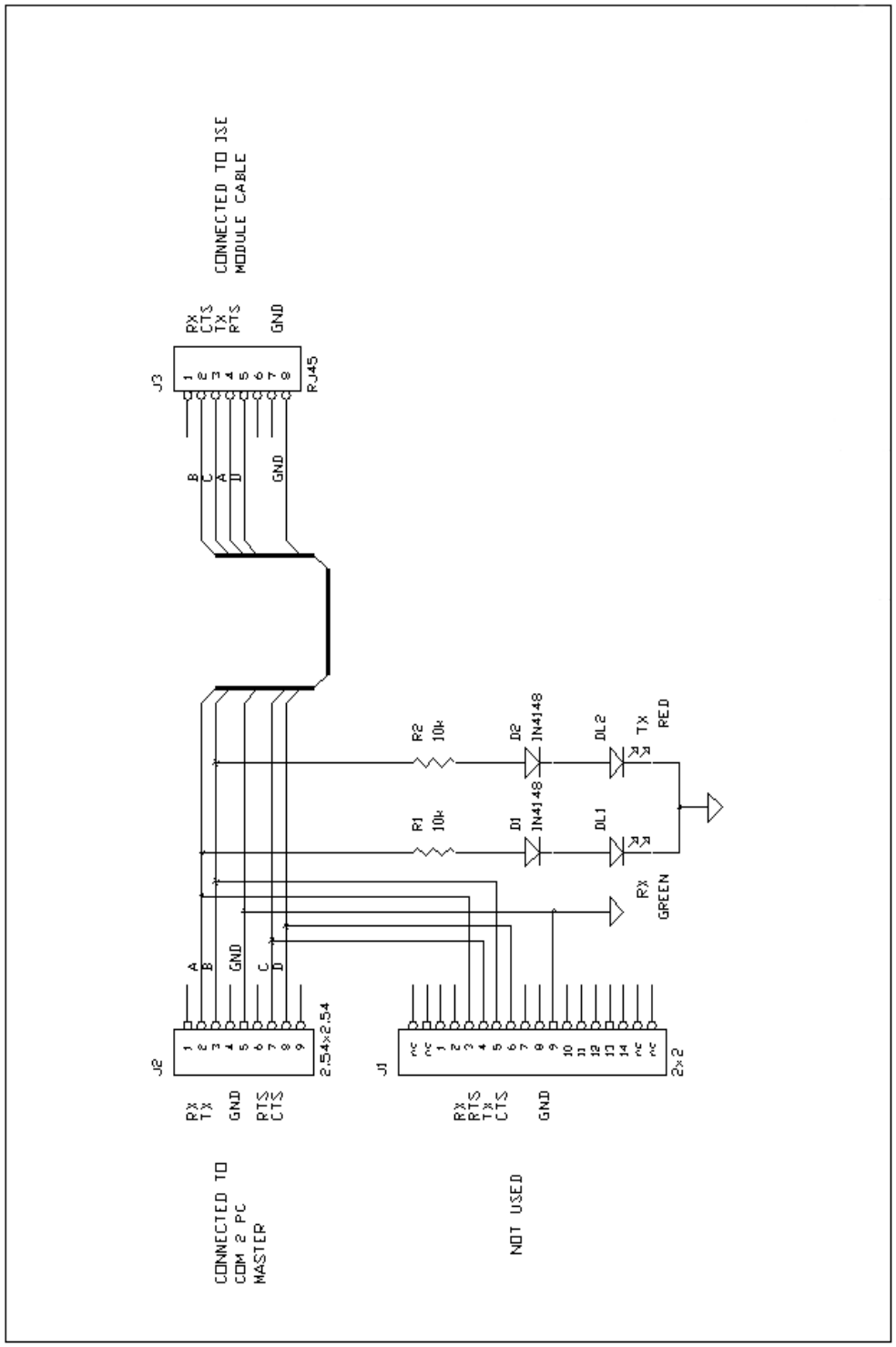
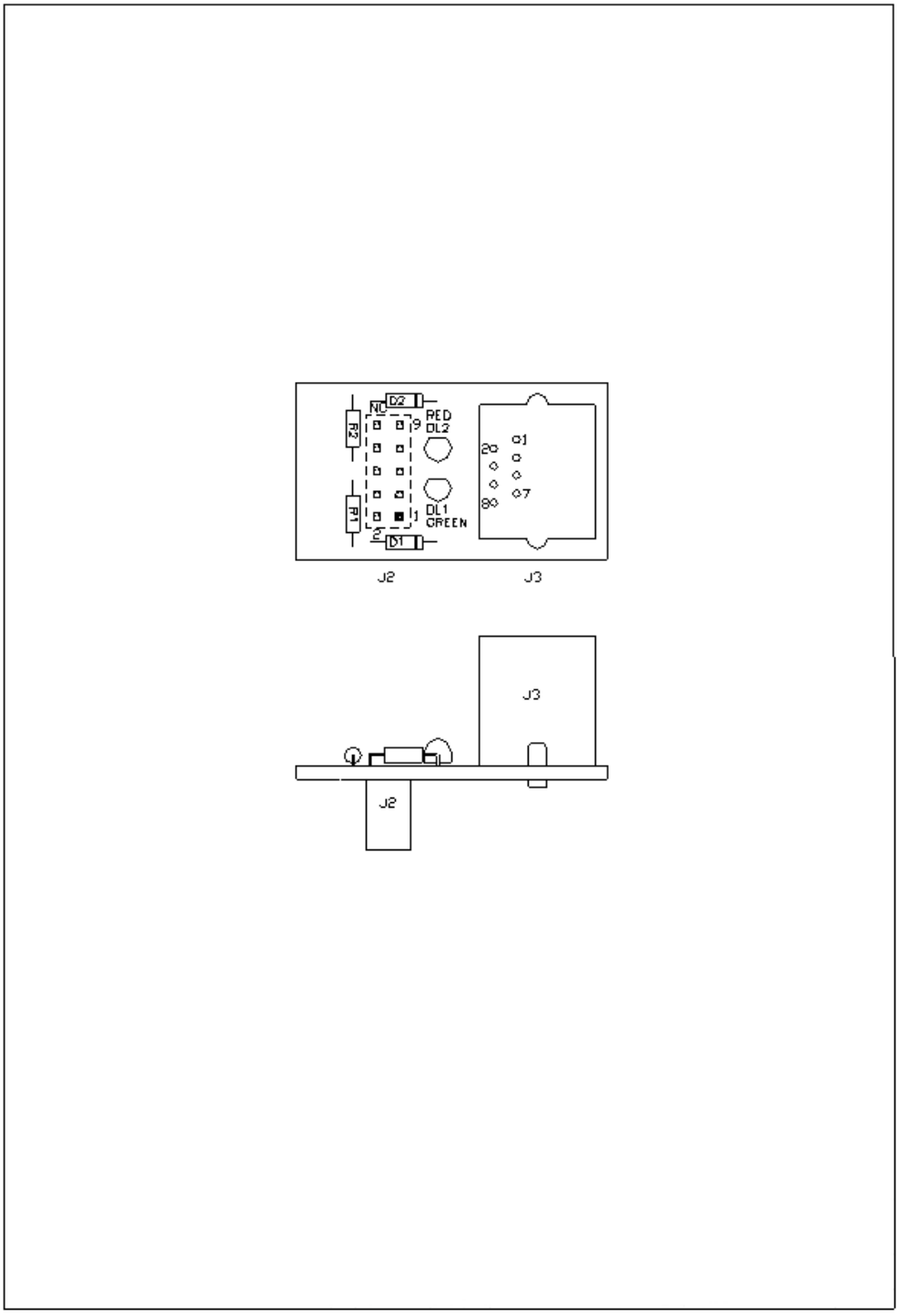


FIGURE 105
Serial adapter - Electrical diagram

FIGURE 106
Serial adapter - Assembly drawing



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